FACTORY

MANAGEMENT AND MAINTENANCE

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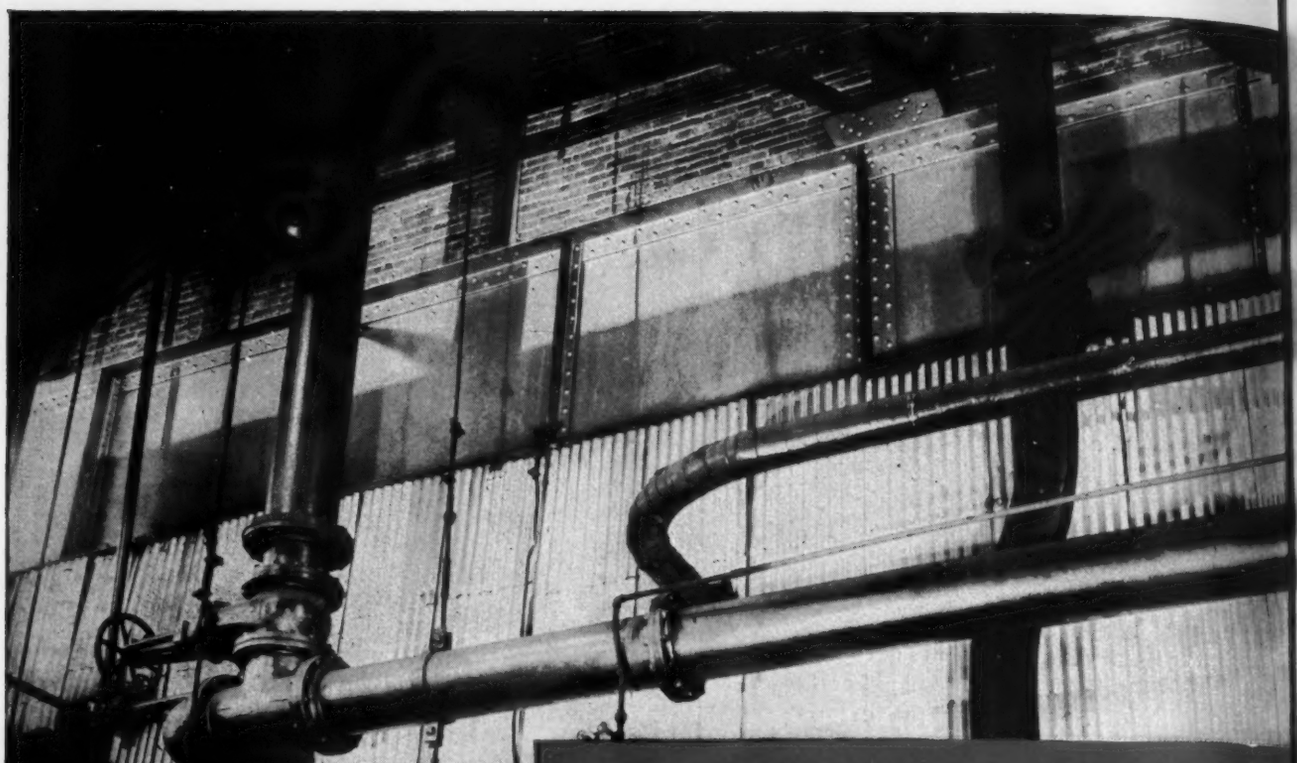
SEPTEMBER 1943

WILSON on War Production

. . . page 82



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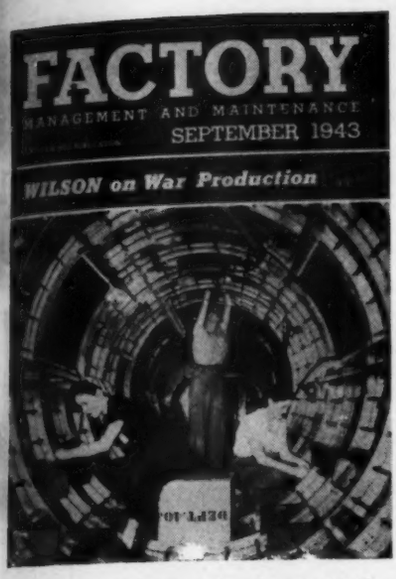

On the cover, three girls at work inside of a Douglas bomber symbolize the major role being played by upwards of 5,000,000 women war workers. The change-over to mass production methods, notably in the aircraft plants, has enabled industry to make full utilization of unskilled help. Kodachrome from OWI.

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FACTORY

MANAGEMENT AND MAINTENANCE

SEPTEMBER · 1943

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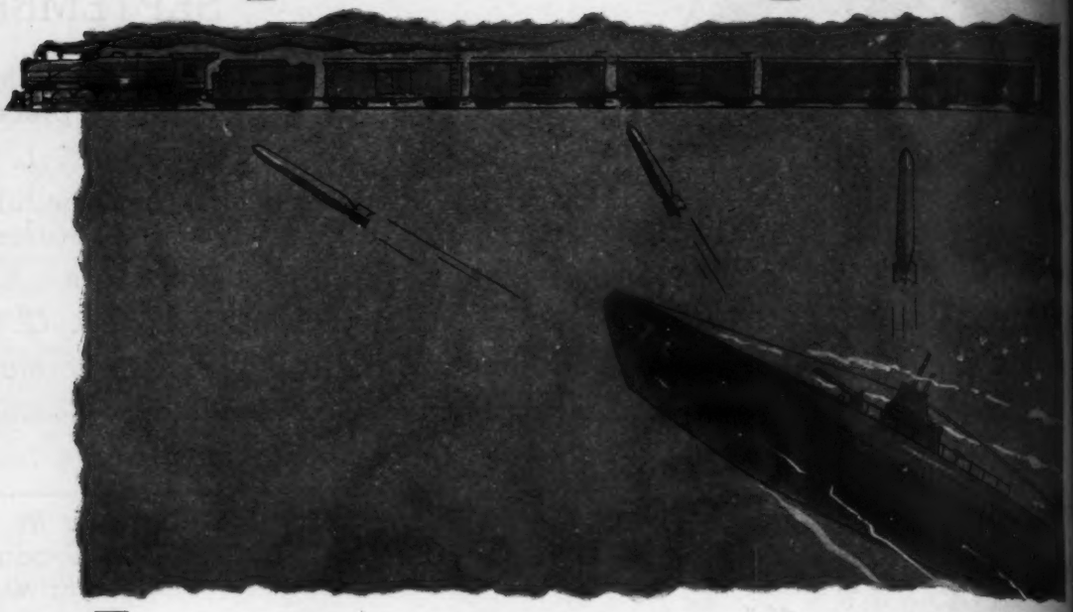
SUB-STANDARD PACKAGING

Torpedoes Shipments



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Aviation—A Progress Report

The Lessons of War Become the Key to a Richer Peace

TUNISIA, PANTELLERIA, SICILY—stepping stones to momentous events! But that is not all. For they spell out across the blue waters of the Mediterranean a pattern of invasion that has progressed far since last summer's first major Commando operation against the French coast.

From Dieppe, you remember, too many of the raiders never got back. But in Tunisia, and on through Sicily, the Allied might plowed inexorably forward, winning objective after objective at a surprisingly low cost in casualties. Air supremacy over the battlefield? Yes. But we have learned, too, how to save lives and shorten the war by strategic air bombardment as a prelude to invasion.

Thus the bombardment plane—rarely seen by the doughboys on the fighting fronts—is destined to save their lives by hundreds of thousands in the decisive attacks that are to come. This fact is confirmed by the cold calculations of the responsible strategists. It will give renewed courage and confidence to every member of the armed forces and of the home fronts throughout the United Nations.

For instance: thorough strategic bombardment of an objective reduces by nearly fifty per cent the surface forces required for invasion. Anticipated losses are reduced from more than fifty per cent of the original ground force to about twenty per cent. Precision bombardment—as used on railroad objectives in Rome—reduces this percentage of loss still further when it is followed by offensive action on the ground.

This is the fifteenth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

The inference is clear. Effective prosecution of the war will require smaller ground combat forces and much larger air forces than some of our strategists once thought.

Our most urgent need, then, is for ever-mounting fleets of aircraft. And, fortunately, this is just what we are getting. The American aircraft industry now is producing as many airplanes as all the rest of the world combined. In 1938 we made 100 planes a month. Now we make three times that many in a single working day. By the end of 1943, our production rate will be about 10,000 a month.

But at this stage of the war, types of planes are more important than mere numbers. In the early months the program was heavy, and properly so, with single-engine trainers. Then, as training planes accumulated, the emphasis shifted to heavier types. Now we are turning out multi-engined bombers at a rate that is the envy of the entire world. Some months ago the President revealed that we were manufacturing 500 long-range bombers every month. The figure was conservative even then. And soon we shall be producing planes of this one type at a rate adequate to replace the normal losses of a fleet of at least 1000 American heavy bombers operating as continuously as the weather will permit.

A glimpse of the poundage production may help us still further to evaluate the miraculous achievements of the aviation industry as a whole. It was 89,000,000 in 1941 . . . 291,000,000 in 1942 . . . 911,000,000 in 1943 . . . and 1,417,000,000 in 1944

– if we need it. There you have the magnificent record of the American aircraft manufacturing industry – a monument to the cooperation of industry, labor, government, and to all-out teamwork between the aviation industry and those other industries which have converted their facilities to the manufacture of airplanes.

What of our enemies and our Allies?

German production probably has flattened out at 2500 a month – with downward revision in immediate prospect. Japan may be able to produce as many as 1000 planes a month – until we get our new long-range super-bombers in sufficient numbers to whittle down that figure. Italy may be able to turn out her 500 a month – for a little longer. At best the maximum Axis monthly total is 4000.

Add to our monthly score of nearly 8000, a total of approximately 4000 for Britain, Canada and Russia, and the United Nations score comes to 12,000 monthly. There we have a three to one advantage for our side. And between our own rising production and the brilliant operations of our bomber commands we should soon boost the ratio well above that figure. Therein lies the certainty of continued and growing air superiority over all the far-flung battlefields.

The critics of American airplane quality have been silenced ever since the ratio of enemy combat losses to our own on bombardment missions surpassed four to one. In the Pacific where our heavily armed and armored planes are knocking off the desperately stripped racing craft of the Nipponese, enemy losses often run as high as eight to one or more. In the Mediterranean theater, where the Italians were abandoned by their Allies, the story is much the same. Only in the well-defended homeland of the Nazis do we sometimes drop below the average, but even in those rare instances the ratio is still well in our favor and the effectiveness of our bombardment is adding constantly to our margin.

* * *

Behind the production lines the battle of research and design still rages. In many a laboratory night-shift, on many a secret test field, new and terrible surprises for the enemy are in the making. Super-bombers, destined for Tokyo, have long since passed out of the design stage and the Japanese may learn about them almost any day. New discoveries, designed to sow swift and silent devastation, are farther along than our enemies believe. No longer will fog or storm or night be permitted to fight on the side of our foes.

The men of science who are toiling to broaden the horizon of our knowledge stand today on the threshold of discoveries that have been sought for centuries. New reservoirs of power may soon exert a profound influence in many fields of technology and through them on our way of life.

Once the war is won these new discoveries will be translated into better living. No longer will countless thousands spend their lives within their own communities or countries. New efficiencies in transportation will bring world travel within the reach of many who once had to stay at home. New family vehicles will navigate the skyways as easily and safely as the highways. Already more than a dozen manufacturers of airplanes, ships, automobiles, and electrical equipment are designing, building, or flying rotary-winged aircraft such as the helicopter or autogyro to meet the needs of tomorrow's families. New and safer aircraft of the fixed-wing type are ready for production as soon as materials become available.

The quality that now makes each of our war planes worth so many of those built by our enemies will be translated into the sturdy reliability demanded by peacetime operation. The devices that seek out and find our enemies behind the veil of fog or darkness will, after the war, reduce weather hazards to the point where they will be no greater in the air than on the ground.

Science and industry will continue to do their jobs and do them well. But if the world is to be made a better place for men to live in, statesmanship must not fail to do its part.

President, McGraw-Hill Publishing Company, Inc.

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FACTORY
MANAGEMENT AND MAINTENANCE
L · C · MORROW · EDITOR

Will Labor Now Comply?

Are there to be penalties for unions as well as employers? The outlook for at least partial government control over unions was brightened late last month by the President's letter to William H. Davis, WLB Chairman, and his Executive Order to the Director of Economic Stabilization (both reproduced elsewhere in this issue). They authorize cancellation of draft deferments of individual employees who refuse to comply with WLB orders and permit withholding or withdrawing from a non-complying labor union any benefits, privileges, or rights accruing to it under terms or conditions of employment.

Full power to enforce compliance on the part of individuals seems to have been given Selective Service and the War Manpower Commission by the Executive Order, in that draft deferments and employment privileges can be canceled. To the extent that work-or-fight means work, individuals will stay on the job and behave themselves. If they would just as soon fight as work, they may choose to kick up a strike ruckus before induction.

Enforcement of WLB orders against unions is not as simple. First, the plant must be taken over by the government—actually a penalty for the employer, not the union. Then and then only can the "benefits, privileges, or rights" be withheld or withdrawn.

If the benefits, privileges, or rights happen to consist of checked-off dues, the government agency taking over can secure the authority to withhold the funds from the union, but only in escrow for the union. Just as soon (or just as late) as compliance is given, the funds are turned over. There is really no penalty; a bank could not keep the money any safer.

The President's letter to Mr. Davis permits the WLB to make concessions to labor rather than invoke penalties. This is not an unimportant concession when such "outs" for labor as extra vacation pay and a 48-hour week with time-and-a-half for hours over 40 are considered. Says the letter, "The Board may, of course, on its own motion, except during government operation, modify its orders in any way it deems appropriate to insure compliance."

Despite the obvious weakness of these arrangements for punitive action, efficacy of the order may be proved in practice. The enforcement powers granted will be really worth while if the WLB is always as firm as it was when, as a punishment for wartime strikes, it refused a maintenance of membership and dues check-off contract to Chrysler CIO United Automobile Workers.

Immediate benefit to the war program may result from the Executive Order. But quite possibly this turn of labor affairs may mean only a belated recognition on the part of the administration that some control over the activities of organized labor is necessary. We are still a long way from a labor policy and a two-way labor law.

L C Morrow

How to Get
Back on

THIS IS NOT a typical "Washington sermon" on production. It is a strong, challenging, altogether frank statement by one of industry's real leaders.

The challenge, while it happens to appear in FACTORY, is not addressed to management alone.

The author has expressed the hope that management men will discuss this article with labor leaders and that both will discuss it with employees, to the end that all may decide to get together on (1) incentive plans, wherever feasible, and (2) war production drives.

THE EDITORS

NEED ANY AMERICAN BE TOLD that the groundwork of our victories in Tunisia and Sicily was laid, months and even years ago, in the factories of the United States? Need any American be reminded that the seeds of disaster on the battlefields of the near future may be sown in those same factories today?

Yet America is admittedly falling short of its attainable production schedules. We are all familiar with the technical and practical obstacles that stand in the way of increased production. Let's recognize them. Even so, it is all too evident that our old enemy, the arch-saboteur Over-Confidence, is getting in some deadly work.

Now anyone who makes such statements risks the accusation of pessimism. This is a risk well worth running. There is a vast and eternal difference between honest optimism and foolish complacency. We are entitled to feel optimistic because we have achieved much. But we have no right to a moment's complacency when American lives are at stake.

And lives—hundreds of thousands of lives, perhaps—are at stake.

It is a thrilling thing to realize that our casualties have so far been "light," blessedly so, unbelievably so by contrast with expectations. They have been "light" because our brilliantly trained troops have moved forward shielded by the greatest concentration of firepower, airpower, and seapower in military history. And they were "made in America."

The Stark Fact

But is there really any such thing as a "light" casualty list? Isn't every single American casualty a tragic, irreplaceable loss which can never be measured in dollars and cents?

The stark fact remains that our total casualties, from Pearl Harbor down to July 3, 1943, have run at the rate of one American fighting man killed, captured, wounded, or reported missing every nine minutes. Is it possible to regard that fact with complacency? Is it pessimistic to warn that casualty rates may rise if our war production rates decline?

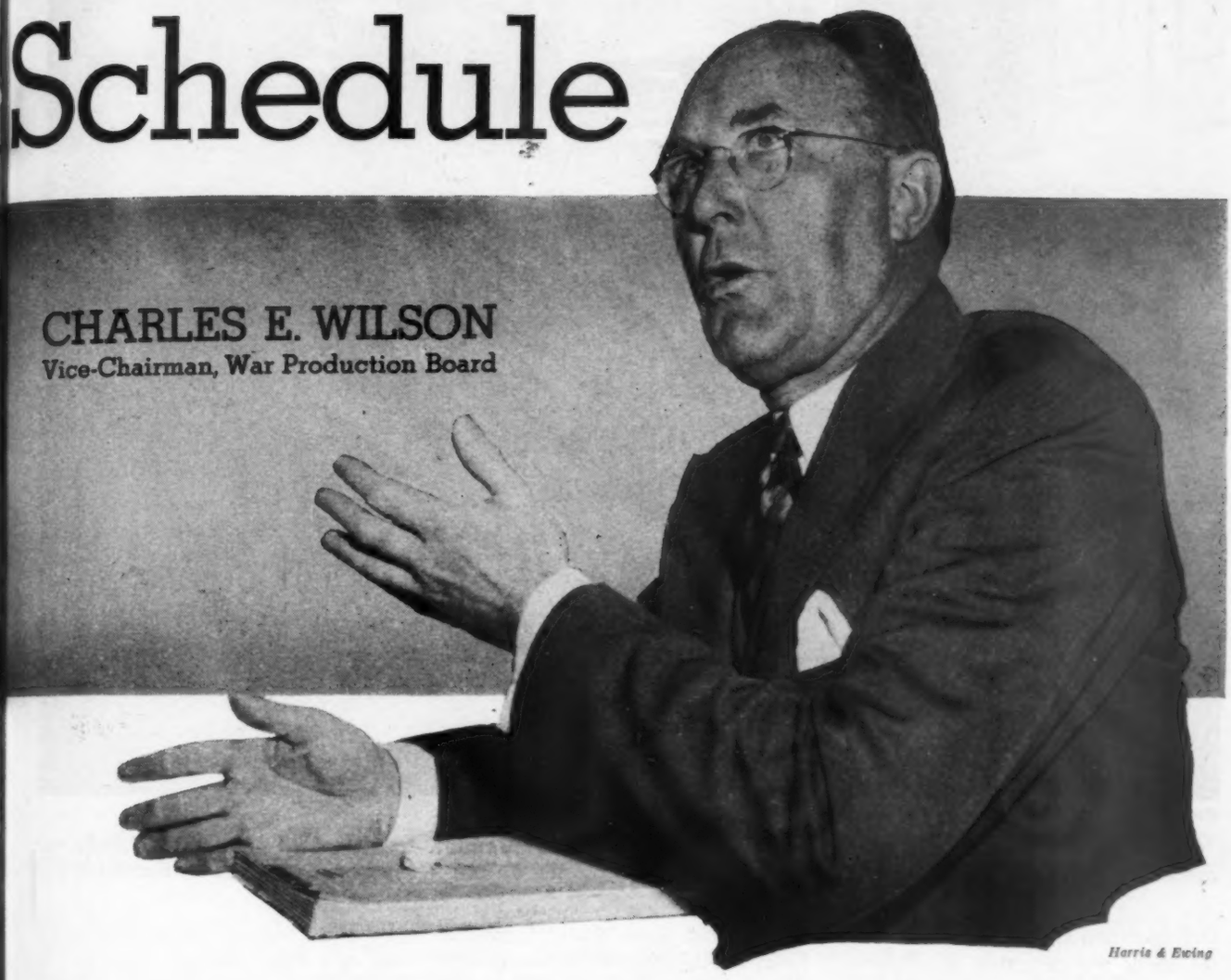
To emphasize the folly of complacency, let us seek a parallel in the realm of sport. The football game is in the second quarter. The home team is behind, 18 to 0. But the situation is far from hopeless. The varsity is in, full strength, and the attack is beginning to roll. Clearly the home team is superior and will overcome its slow start in time. Its ground plays are clicking, its blocking is perfect, its passes are finding their marks. It rolls up one first down after another as it smashes forward to the enemy's goal.

Does the home-team crowd, at this point, stop rooting and go home? Does the home team relax? Does the visiting team give up? Do its partisans lose hope? Not if everyone sees the scoreboard.

Let us look at the scoreboard of this war.

The United Nations have recaptured a portion of North Africa. This is territory which was held by the Allies throughout the first World War.

Production Schedule



CHARLES E. WILSON
Vice-Chairman, War Production Board

Harris & Ewing

We have taken Sicily, which was Allied territory throughout the World War, and we are in a position, at this writing, to reclaim Italy, which fought on the side of the Allies throughout the World War. The area of Sicily is scarcely a tenth of the area of continental Italy which, in turn, is only one-seventeenth of the area of Europe, exclusive of Russia. And, in mid-August of this year, Germany's armies still held a far larger portion of Russia than they did when the Russians accepted defeat at Brest-Litovsk in 1918.

In the Orient, meanwhile, the Japs (who were our allies, however passive, in 1918) have, since 1940 alone, seized 1,500,000 square miles of territory exclusive of the large areas of China where Japan's occupation is incomplete. This has brought the resources of these conquered areas and at least 110,000,000 of captive manpower, actually or potentially productive, under Nippon's thumb. And as of mid-August this year we have recovered Guadalcanal, 2500 square miles in area; Attu, 325 square miles; and Munda.

Mere area, of course, is not the sole measure of strategic success. But we have learned, even in Sicily, that—no matter how effective our air attack—*the ground forces must follow through.* They must, in the very nature of things, suffer losses as they move.

And we have learned in the Orient that seemingly we shall find, every step of the way from Munda to Tokyo, a green-clad Jap behind every tree who will have to be blasted out and killed before our armed forces can move another step forward.

Is it pessimism, then, to suggest that final victory may take time and cost lives? I believe I am an optimist, for I believe that victory is within our grasp. I think we can put over the final smashing blows *soon*—if, with the song of victory on our lips, we redouble our productive efforts, rather than relax them.

One thing we cannot afford to forget is this: The manufacture of 75-mm. shells at Frankford Arsenal in Philadelphia (or hand grenades in Toledo, or planes on the West Coast, or guns in Hartford) and the occupation of Sicily constituted one continuous mili-

Harris & Ewing photographs

"One thing we cannot afford to forget is this: The manufacture of 75 mm. shells at Frankford arsenal in Philadelphia (or hand grenades in Toledo, or planes on the West Coast, or guns in Hartford) . . .

tary operation from the day the order for shells was accepted in Philadelphia to the day the command to advance was given in Sicily.

The production order was a military order just as surely as the command to charge was a military order. Excuses and letdowns are no more acceptable on the production front than they are on the military front. Yet recently an important military operation abroad had to be postponed because a single industrial plant at home suddenly slipped from a high production rate to an incredibly low rate of output.

Now let us look at the production scoreboard.

American industry has rolled up a truly magnificent record. When you look back and realize that, just a short time ago, we were virtually without a munitions industry, our achievements seem almost incredible. From $1,463,000,000 of war production in January, 1942, the first month after Pearl Harbor, to $5,280,000,000 for July of this year—that's the record and it's on the scoreboard for the world to see.

A Challenge Accepted

And industry put it there! All honor to the thousands of men in plant operation who accepted their country's production challenge, rolled up their sleeves, and did the seemingly impossible. All honor to the millions of employees who have quietly given their level best, day in and day out, to the war effort. All industry and all America can take a great and honest pride in production rates which have risen constantly and are still rising.

Nevertheless we must face the fact that the scoreboard shows that we are not now fully meeting schedules. In the first six months of 1943, national production for war totaled 43 percent of the year's scheduled total. This means that, in order to reach our goal at the year's end, it would be necessary to increase production rates an average of 30 percent for the last half of 1943.

To a real optimist, such an increase seemed—and still seems—possible. In July, therefore, we undertook a substantially stepped-up schedule. We did not meet this schedule in every category, notably in airplanes. Plane production was magnificent, but it was still approximately 10 percent short of what the scoreboard says it should have been. It would be wrong not to be concerned about this fact. It would be wrong not to examine the human factors involved to see whether there is any tendency on the part of any

". . . and the occupation of Sicily constituted one continuous military operation from the day the order for shells was accepted in Philadelphia to the day the command to advance was given in Sicily"

large number of people to forget the magnitude of the job ahead. Such a tendency, if it exists, can become very costly in terms of victories postponed and lives lost. And it is disturbing to have to report that recently there have been individual plants—exceptions, to be sure—in which not only the rate of production but production itself has fallen off as much as 25 percent for no clear, visible reason.

What, then, is lacking? Why are we not meeting schedules?

A foremost—perhaps *the* foremost—limiting factor is the admitted scarcity of manpower. We need not belabor the reasons for this. Every management knows that we are stretching our manpower reserves to the utmost. Every management is confronted with the necessity for increasing its working force while losing men to the armed services. Every management knows the difficulty of meeting schedules with new, untrained recruits in the face of unprecedentedly heavy turnover rates.

We have long since passed the point where management had simply to call in more factory help in order to get more work done.

How to Get More Output

Now, since labor *supply* has become problematical, it seems only logical *to make the most of the available working force.* A potentially huge increase in production remains to be tapped through the stimulation of the individual's desire to produce.

How can this best be done? There are, I believe, two principal ways:

1. By the use of incentive plans.
2. By awakening people psychologically to the need for greater production—by building in America's wage earners the "will to win."

Now I hope no one supposes that I am blindly advocating the immediate, nationwide application of some one simple formula for incentive payments as though the whole idea of incentive payment was something I had just discovered for the first time in my life. I welcome this opportunity to clarify for the readers of FACTORY my attitude in this respect. And these are the points I want to make:

1. While there is nothing new about the incentive principle, we have today a *new opportunity* to apply it successfully and a *better reason* for applying it than ever before.

2. In war and in peace, men like to work toward a known goal. Better

still, they like to *beat* a known goal. And if this was so in peace, it is doubly so in war.

3. Incentive systems have always got good results *provided* they were properly conceived and fairly administered. Today, if they are so conceived and so administered, they have a better chance of succeeding than ever before. Some of the technical obstacles may seem to have increased, but the psychological obstacles are at a minimum.

4. We have learned through the years that the most successful incentive plans are the simplest, the easiest to grasp, the easiest for management and labor to agree upon, and the most productive of immediate, tangible rewards to all concerned.

5. For these reasons, I am advocating the principle, wherever applicable, of increased payment to labor in exact ratio to increased production on a plantwide basis over a specified period of time. This may oversimplify it a bit, and I shall elaborate in a moment, but the basic principle is as follows:

If it can be shown that a 10 percent increase in production over reasonable standards has been secured in a given plant, then the entire working force in that plant should receive a bonus of exactly 10 percent.

Reasonable standards are, of course, essential. Say that at normal working speeds, it takes a given working force 1,900,000 man-hours to produce 100 bombers within a given period. If, in the next comparable period, the same force produced 110 bombers in the same number of man-hours, then all the members of that force should receive a bonus of 10 percent to be paid by the company. And, by the way, I would include engineering and operating management below the rank of top company officials in the reward.

The application, with necessary variations, of this principle summons up the productive spirit of group performance. It makes the shirker and the absentee conspicuous to his fellows. It stimulates the group's desire to seek improved methods and reduce waste. It eliminates the time-taking technical task of setting up time study measurements for individual performance. It allays most of labor's historic, and sometimes justified, suspicions. And it affords one of the most acceptable solutions to wartime government wage and price controls.

Labor wins in a way that is readily obvious to labor. Management wins because 10 percent more units, sold at the same price, mean 10 percent more profit—augmented by reduced overhead on the last 10 units.

Above all, *the nations wins*—and American lives are saved.

6. There are certain recognizable limitations to this or any plan. I know from experience most of the objections to incentive systems which management and labor are likely to raise. There are recognizable weaknesses in the plantwide bonus plan. For example, we know, because we have seen it work, that this type of plan can increase production as much as 25 percent in plants that produce a single product, or one or two products, on a continuous basis. But we doubt that it is applicable to diversified-product plants. The latter should try to adapt some of the many excellent types of piecework or group bonus plans which certain managements have tried and tested through the years.

No one can prescribe for individual situations without embarking on a book. But there is usually an answer to every obstacle—if you hunt for it hard enough. And of this you can be sure:

The government will be glad to meet industry halfway in putting through any proposal which promises a worth-while increase in production.

The big thing to remember about all incentive plans is that they must be undertaken by management and labor in a spirit of sincere cooperation. And that, under war conditions, should not be difficult to achieve *if everyone understands the need.*

This brings us to the question of the War Production Drive.

As you know, these drives have been inaugurated in some 2300 plants. Not all of them have succeeded, we admit, but a surprisingly high percentage of them have made splendid contributions not only to the war effort but also, I think, to the whole cause of better industrial relations.

It hardly seems necessary to go into detail about these drives. WPB is doing all it can to encourage their extension. Our Production Drive Headquarters is geared to give every possible assistance to industry in launching new labor-management committees. The drive idea has long since passed the novelty stage. We have available a large volume of case-history material for the guidance of those who plan to sponsor new drives.

One fundamental point should be emphasized:

There is everything to be gained from (1) constantly hammering home the great and immediate connection between production in the plant and action on the fighting front, and (2) making known every bit of specific information possible about production quotas and goals.

I realize this is not always possible, but I believe there are many cases in which it could be done to good effect. For example, a production scoreboard that shows a definite number of so many units of a product to be produced in so many weeks or months seems to me to be twice as effective as one that merely sets the goal in vague percentages. Where possible, too, it seems desirable to issue information on backlogs as a means of giving employees a sense of the size of the job ahead.

When quotas are known, the employee feels personal pride in meeting or beating them and a personal sensation of failure when the goal is not reached. Perfect frankness is, of course, required. If the quota is not reached for good reasons beyond the control of management or labor, then those reasons should be made known. It is another of the verities of industrial relations, as true in peace as it is in war, that management *gains* the confidence of labor when it *shows* confidence in labor.

A recent upturn in the activities of the War Production Drive indicates that management and labor are showing a renewed interest in cooperative effort. This is the ideal time for it. Like a soaring plane, American industry has pushed production upward and upward until it has hit the "stratosphere"—much sooner than we may have hoped, or the Axis may have feared, we would. With a psychological supercharger, so to speak, we can drive on, higher and higher, faster and faster, until the final victory is ours.

How Change-Over to Product Layout Cut Unit Costs

EDWARD FINSLEY, Standards Department, The Huffman Manufacturing Company, Dayton

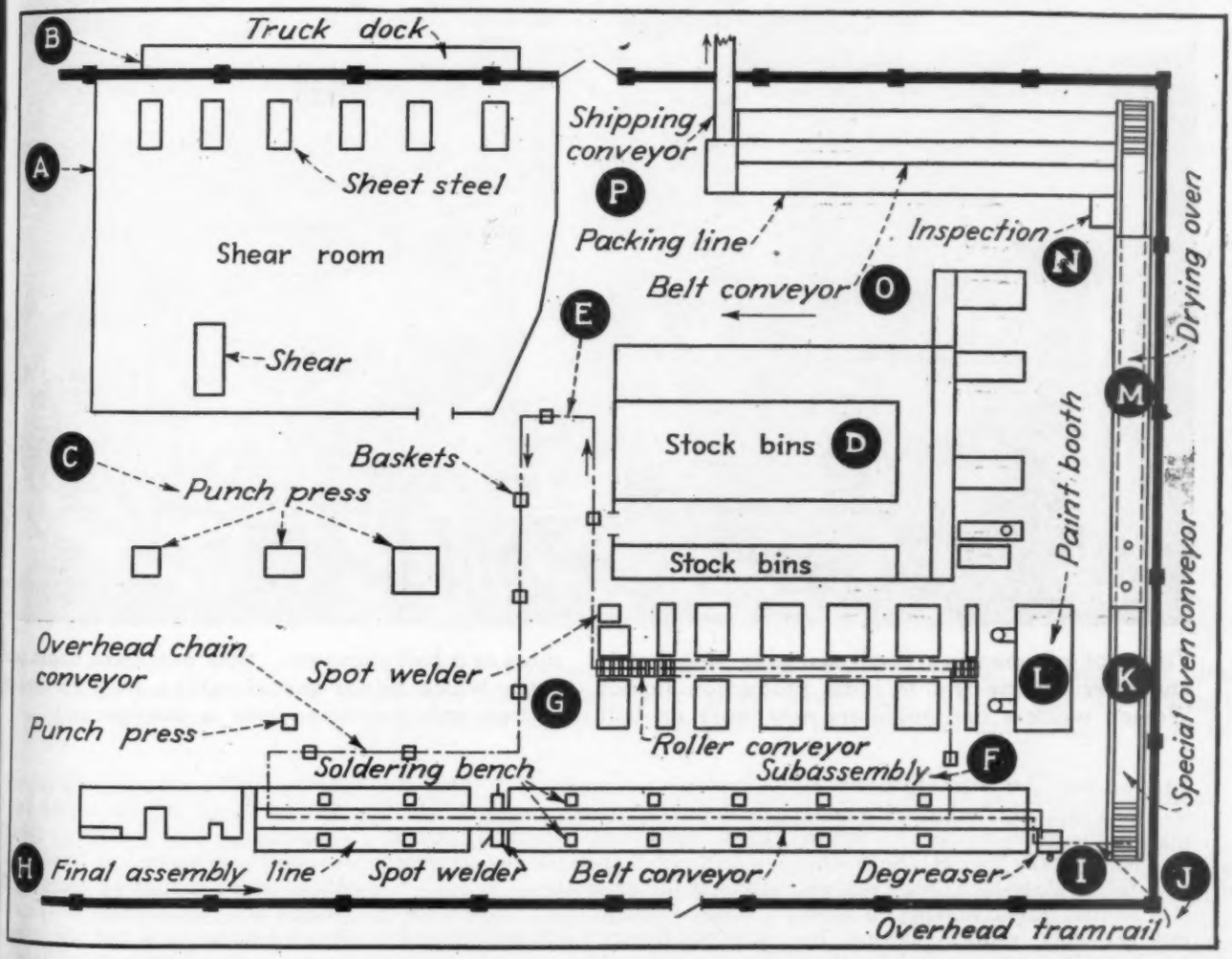
How GOOD LAYOUT invariably leads to lower unit costs has perhaps never been better instanced than in our oil measure department, which was completely changed over early this year and put on a mass production basis. It seems that this department just expanded through the years in a vain effort to keep up with increasing volume of business. Machinery was placed wherever there seemed to be room, without any serious consideration being given to sequence of operations.

All this has now been changed. Costs have been cut nearly 30 percent. Distance traveled has been reduced from 4800 to 480 feet, a saving of 90 percent! Jobs have been further broken down so that each employee in the department has a specified operation. A new group bonus system has supplied an incentive that was lacking before. Employees now make a better average week's pay. And working conditions have been immeasurably improved by the change.

A round-by-round description of the new layout will indicate the steps that were taken in changing over the department. Letters in the text refer to corresponding letters on the accompanying sketch.

A shear room (*A*) was built, to contain sheet stock and shears, directly behind the truck dock (*B*) from which stock is unloaded. Punch presses (*C*) were equipped with individual motors and put into proper sequence to take care of the stock as it moves toward the assembly line.

We set up a centralized stockroom (*D*) for all parts needed to assemble

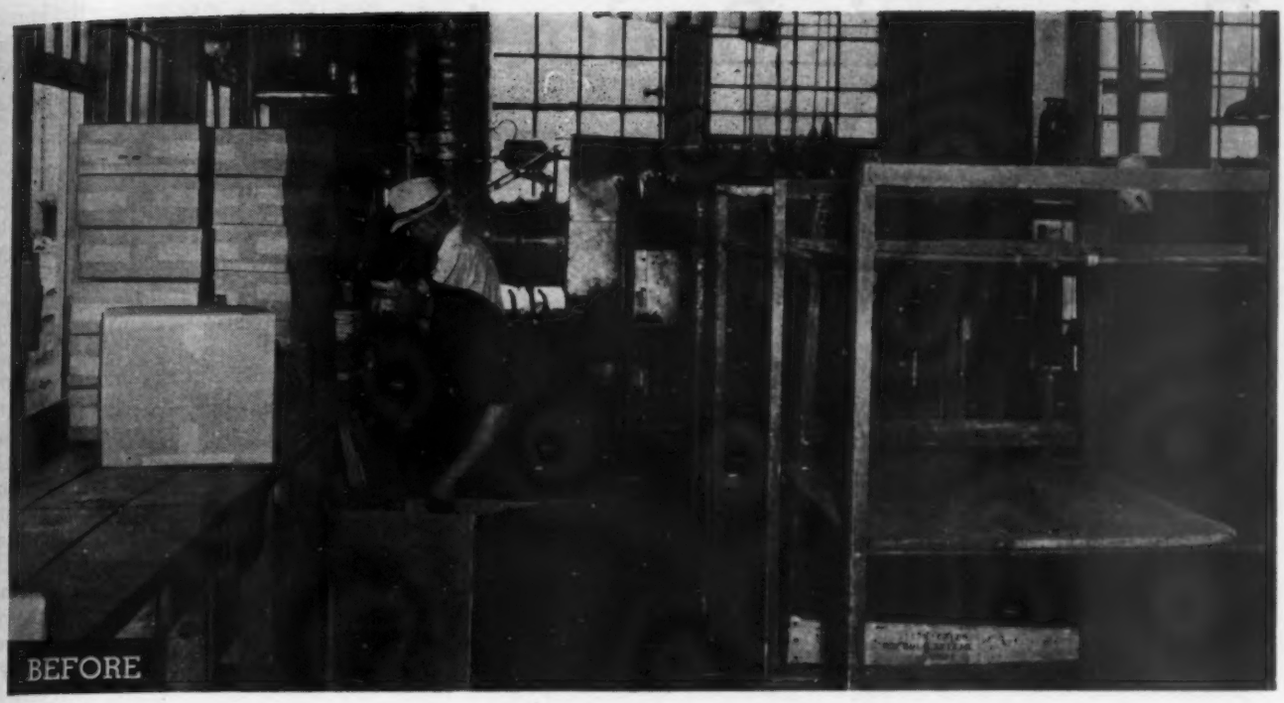


By laying out its oil measure department on a product basis, Huffman Manufacturing Company has cut travel 90 percent, unit costs 30. Letters indicate sequence of operations described in the text. With mass production, jobs are broken down to the point where women can be quickly trained to handle them

Views of oil measure final assembly line before and after change-over to mass production layout. Women welders and solderers now work on both sides of a belt conveyor. Note overhead chain conveyor which brings subassemblies from stockroom or from subassemblers seen in background

oil measures. An overhead conveyor (*E*) goes past this stockroom carrying stock to the subassemblies (*F*) and to the final assembly line (*H*). Subassemblies are put alongside a roller conveyor (*G*) so that people working on them can get stock without moving, by merely taking parts required for their assembly off the overhead conveyor (*E*), which runs between the two lines of subassembly workbenches. The completed assemblies are then put back on the same conveyor, which carries them either into the stockroom or to the final assembly line, if needed there at the moment.

Final assembly (*H*) consists of a large belt conveyor with workplaces for women spot welders and solderers set up on both sides, properly placed to do the necessary operations in sequence as the oil measures move along the conveyor. We also secured a degreaser (*I*) and rigged it with a wire basket to catch the oil measures as the last assembly operation is completed. Measures are dipped by means of an electric hoist on a tramrail (*J*), into the degreasing tank and are brought up again completely cleaned. Here we change from belt conveyor (*H*) to a fireproof conveyor (*K*) to carry parts through the enamel-drying oven. The



Before and after views of packing section reveal vast improvements not only in methods but also in working conditions. Packing is now done on the conveyor line. And fluorescent lighting units plus good white paint have transformed this ancient plant into one that workers are proud to work in

paint booth (*L*) is set directly behind the conveyor (*K*), making it easy for the sprayer to take the oil measures from the conveyor, spray them, and put them back on the same conveyor, which then proceeds to take them through the drying oven (*M*), from which they emerge baked.

Our inspector stands beside the oven conveyor at the end (*N*) of the drying oven. After he inspects and approves the measures, he puts them on another belt conveyor (*O*) which carries them to the packers. Packing is done on the conveyor, and cartons proceed on their way, dropping off at the end of the packing conveyor to another conveyor (*P*) which takes them to the shipping department in a nearby building.

The finished product, from the time it goes into the first assembly until it is loaded on the truck ready to leave the factory, is never carried by hand. Workers are not placed too close together to diminish their efficiency, and still we have been careful not to let any space go to waste. To take care of fluctuations in production, we have a variable speed drive on our final assembly conveyor. It takes only a minute to speed up or slow down production as our schedule requires.

Foremen's Budgets Save 20 Percent

G. M. RICHARD, Works Manager, Toledo Scale Company, Toledo, Ohio

EVERY FOREMAN in our plant operates on a budget which tells him on any given day whether or not his expenses are behaving as they ought to. The plan has been in successful operation for the past seven years and has enabled our foremen to reduce by 20 percent the expenses within their control.

When business really began to move out of the doldrums at the end of the last big depression, we found we had to have a method to keep operating expenses in the factory from getting out of hand.

Of course, the ready answer was a general budget. There were several reasons why this answer did not seem to fit our particular situation. Among them was the great variation in products to meet customers' needs. One portable scale, for example, was made in some 15,000 variations. Calculation of expected sales, and the relation of a particular expense in an operating department would be difficult. We wanted a device that would serve as a norm for each item of the foremen's controllable expense, and, at the same time, could be operated with a minimum of clerical work. We did not want something that would require constant revisions, with consequent alibis, if the budget were not met. The plan worked out, and in successful operation during these years, has no direct relation to the general company budget.

The departmental cost sheet for assembly department No. 1 illustrates the general plan; each departmental foreman has a similar sheet.

The basic method of setting up these budgets, or cost sheets, is the same—a definite relation is established between productive hours and each item of expense. If, at normal yearly operation, 100,000 standard hours of productive labor are required in a department, and a particular expense amounts to $10,000 then the budget rate is set at 10 cents per hour. At the end of the month, the budget may be figured by multiplying this rate by the actual productive hours utilized for the month. Items of expense in each department that are over or under the budget, or norm, are thus quickly determined, and form the basis for changes and revisions where necessary.

This end-of-the-month computation is not the first inkling that expenses may not be running according to plan. As experience with the plan accumulates, each foreman becomes acutely aware of the fact that he has so many cents per hour for each item of expense. If his 20 operators, let us say, are reduced to 10 by a variation in schedule, he knows immediately that every item in his controllable expenses must be reduced proportionately. He begins to make his plans for reductions, and, in our experience, is quick to consult the comptroller and the factory manager as to ways and means. If, for instance, the full time of one indirect worker cannot be utilized with the reduction in schedule, the foreman will consult a fellow foreman to see if he can use that part of the indirect worker's time.

Indicates Need for Change

No budget plan, no matter how complete and detailed, will do more than this—indicate to an operating foreman that immediate change is required if total monthly expense figures are to show satisfactory results.

The departmental budget cost sheet illustrated on the facing page indicates, with hypothetical figures, the cents-per-hour allowance established for each controllable item of expense, in the column headed "Budget Rate per Standard Hour." The month-end budget for the current month is secured by a multiplication of each hourly rate allowance by the actual and standard hours respectively; the cumulative budget, last three columns, is secured in the same way. Excesses are stated in traditional red figures.

A consideration of some of the items on the budget sheet may serve to indicate how satisfactory control may be determined without a lot of fuss and feathers. Repairs to equipment, for example. An analysis of this expense in a particular department may indicate that $5000 was spent in the base year used to determine the hourly rate. Of course, a non-recurring item of this kind would be eliminated before the rate is calculated; on the other hand, if an estimated similar amount were to be spent in the coming year, this would be added before the rate per productive hour is set.

Considerable doubt may arise as to the advisability of including account 22, "Engineering errors and specifications changes," in an operating foreman's controllable expense. Perhaps it has theoretical faults; practically, however, it results in the desirable situation of the foreman's calling attention to the fact that this item is exceeding the allowance.

The absence of some items may be noticed. Power, light, water, heat, and building maintenance are prominent omissions, and purposely so. We used to include these items, but found that, while some small saving may be made if an unused light is turned off promptly, their inclusion offered an opportunity for a "beefing" foreman to sabotage the good points of the budget. The building of good habits of daily control of supplies and indirect labor will spread—the foreman wants something that will serve as a reasonable and fair measure of his importance and worth to his company.

It just happens that in this assembly department budget sheet no inspection, such as floating inspectors responsible to the foreman, is required. In machining departments this is necessary, and the number of cents per productive hour allowed is determined in the manner already explained. There is an item for general inspection, however, under the heading, "Manufacturing Expense—other Items." This item is controlled by the chief inspector—not by the foreman, and together with all others in this group for which the foreman is not responsible, is listed as non-controllable. These items are included in this manner, and at the total amount, to round out the picture of indirect operating costs of a manufacturing department. This method serves notice, also that these items do not appear in the list of controllable expenses for which the foreman is held responsible.

Perhaps it should be pointed out that all foremen are treated alike in this plan—the norm is determined in the same way for all through the setting of so many cents per productive hour for each item of controllable expense. Moreover, these allowances are based upon the operating experience of each department separately. Let us suppose, for example, that the situation indicates a need for a 10 percent reduction in operating expenses

DEPARTMENTAL COST SHEET
Toledo Scale Company

Department Assembly #1 Date Dec. 31, 1942

Foreman

		This Month			This Year		
		Actual	Budget	Over Under	Actual	Budget	Over Under
Productive Labor - Amount		4921.00	4921.00		51500.00	51500.00	
" " - Actual Hours		4800.00			51800.00		
Manufacturing Expense - Controllable							
	Budget Rate Per Std. Hour						
02 Trucking	$ .0187	1.00	144.00	143.00	312.00	1518.00	1206.00
03 Inspection							
04 Recondition Stock Sales	.0001		1.00	1.00		8.00	8.00
05 General	.0077	93.00	59.00	34.00	308.00	625.00	317.00
07 Super. & Clerical (Except Foreman)	.0108	63.00	83.00	20.00	896.00	877.00	19.00
09 Defective & Spoiled Work	.0108	2.00	83.00	81.00	80.00	876.00	796.00
09 Transfer Charges		4.00	-	4.00	21.00		21.00
10 Group Allowance	.0056	22.00	43.00	21.00	324.00	455.00	131.00
12 Enameling Material	.0008	4.00	6.00	2.00	72.00	65.00	7.00
16 Set-Up							
21 Experimental Expense	.0003		2.00	2.00		16.00	16:00
22 Eng. Errors & Spec. Changes	.0018		14.00	14.00		146.00	146.00
25 Office Supplies	.0016	8.00	12.00	4.00	110.00	122.00	12.00
29 Freight Express & Cartage					3.00	-	3.00
33 Repairs to Machy. & Equip.	.0086	1.00	66.00	65.00	610.00	698.00	88.00
34 Repairs to Tools	.0006	5.00	5.00	-	21.00	49.00	28.00
42 Factory Supplies	.0117	385.00	90.00	295.00	1215.00	940.00	275.00
Scrap	.0223	163.00	172.00	9.00	1540.00	1810.00	270.00
07 Foreman					117.00		117.00
Total		751.00	780.00	29.00	5353.00	8205.00	2852.00
Percent of Productive Labor		15.3	15.9		10.4	15.9	
Manufacturing Expense - Other Items							
03 Inspection	.1714	840.00	1320.00	480.00	12200.00	13900.00	1700.00
18 Overtime					710.00	-	710.00

A monthly departmental budget or cost sheet. It is computed at the month's end by applying the budget rate per standard hour to the actual hours used. Expenses for which the foreman is not responsible are under "Manufacturing Expense—Other Items." Circled figures were in red in the original form

for 1942: the necessary adjustments may be made easily and fairly—and what is very much to the point, the foremen realize and accept the matter as fair and that no disproportionate burden is thrown upon anyone.

Perhaps enough has been said to indicate the philosophy back of this budget plan. If there is a question of terms and definitions, we admit frankly that this is not a budget, if by that term is meant an initial sales estimate with all expenses eventually tied to a company financial plan for the year. There will not, however, likely be objection to stating that this plan does determine, pre-determine if you please, what a standard productive hour should cost in supplies and in indirect labor—we have experienced, generally, a 20 percent reduction in the cost of each productive hour over the past seven years.

This result is tangible enough certainly, but in the accomplishment of it other advantages have come as by-products; foremen are more alert and more company minded; increased interest is manifested in their jobs. Although no bonus is provided for better than standard performance, there is a measure of what good performance is, and everyone will respond favorably to a fairly determined norm or standard which permits the development of confidence in individual performance.

To be sure we had some difficulties at the beginning—there was a tendency to explain away high items of expense. But as experience was gained, and as confidence grew in the fairness of the plan, it came to be used, and regarded, as a road map in running each operating department. This plan was developed in peacetime and has been in operation for several years. In some new departments devoted wholly to specialized war production, sufficient cost experience is not yet available to establish norms, but that is merely a question of time.

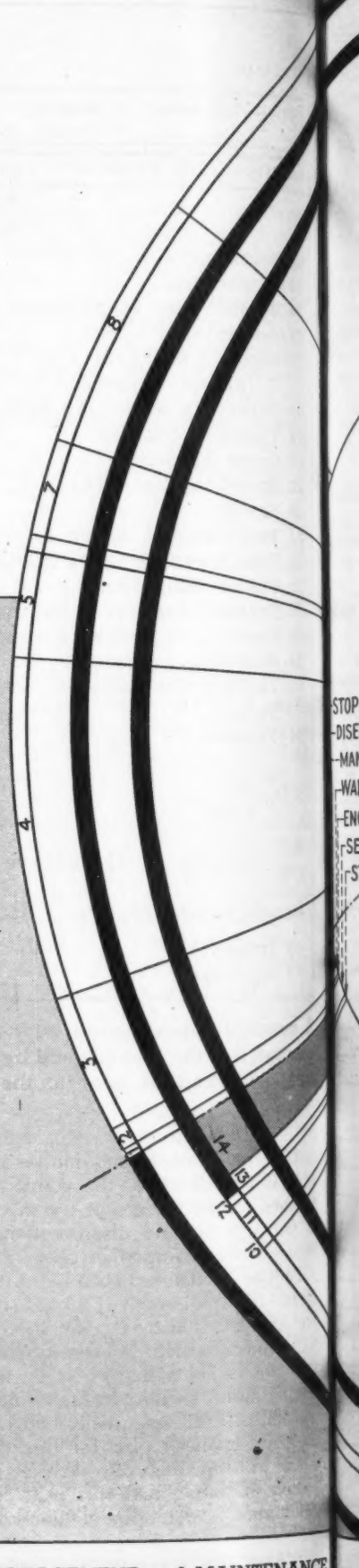
Charting Man and Machines

HAROLD M. HUSTON, Southwest Welding & Manufacturing Company, South Pasadena, Calif.

SHOWN HEREWITH is a man-machine chart. It is a picture of one man running three lathes.

It is different from the conventional chart of this type. The time-honored method is to draw a man-machine chart as a set of parallel, theoretically endless lines. Each line represents a machine and is marked at appropriate intervals to show what's doing. Thus time marches on, down the long chart, and sooner or later everything comes out even, whereupon the chart maker starts in doing it to the machines all over again, three or four feet farther along. This "endless" feature is a nuisance—and a waste of paper, too. So I sat me down to eliminate it. The result is a circular chart. Only one cycle is shown, no more and no less. No more butcher paper, or spliced graph paper, or adding machine tape! Instead, a far clearer picture of what's going on, and only one chart to make.

It is a simple matter for the reader to begin at the top of the circle with the operation, "disengage feed," and follow the operator through the various steps required in running the three lathes. Fine computations and clarifying comment are given below.



Computation and Comment

No.	Operation	Hours
1	Disengage feed	0.0005
2	Stop machine	.0010
3	Return carriage	.0068
4	Remove part	.0169
5	Place in box	.0051
6	Reach to box	.0008
7	Pick up part	.0049
8	Chuck and tailstock	.0126
9	True up	.0318
10	Start machine	.0008
11	Set to cut	.0021
12	Engage feed	.0005
	Machine idle	.0838
	Machine cutting	.1816
	Machine cycle (360°)	.2654
	Assume 3 machines Then 0.2654 ÷ 3 is: Time available per machine	0.0885
	Time required per machine	.0838
	Difference	.0047
13	Walk to next machine	.0010
14	Wait for operation No. 1	.0037*

Thus, idle time is 0.0037 hours *

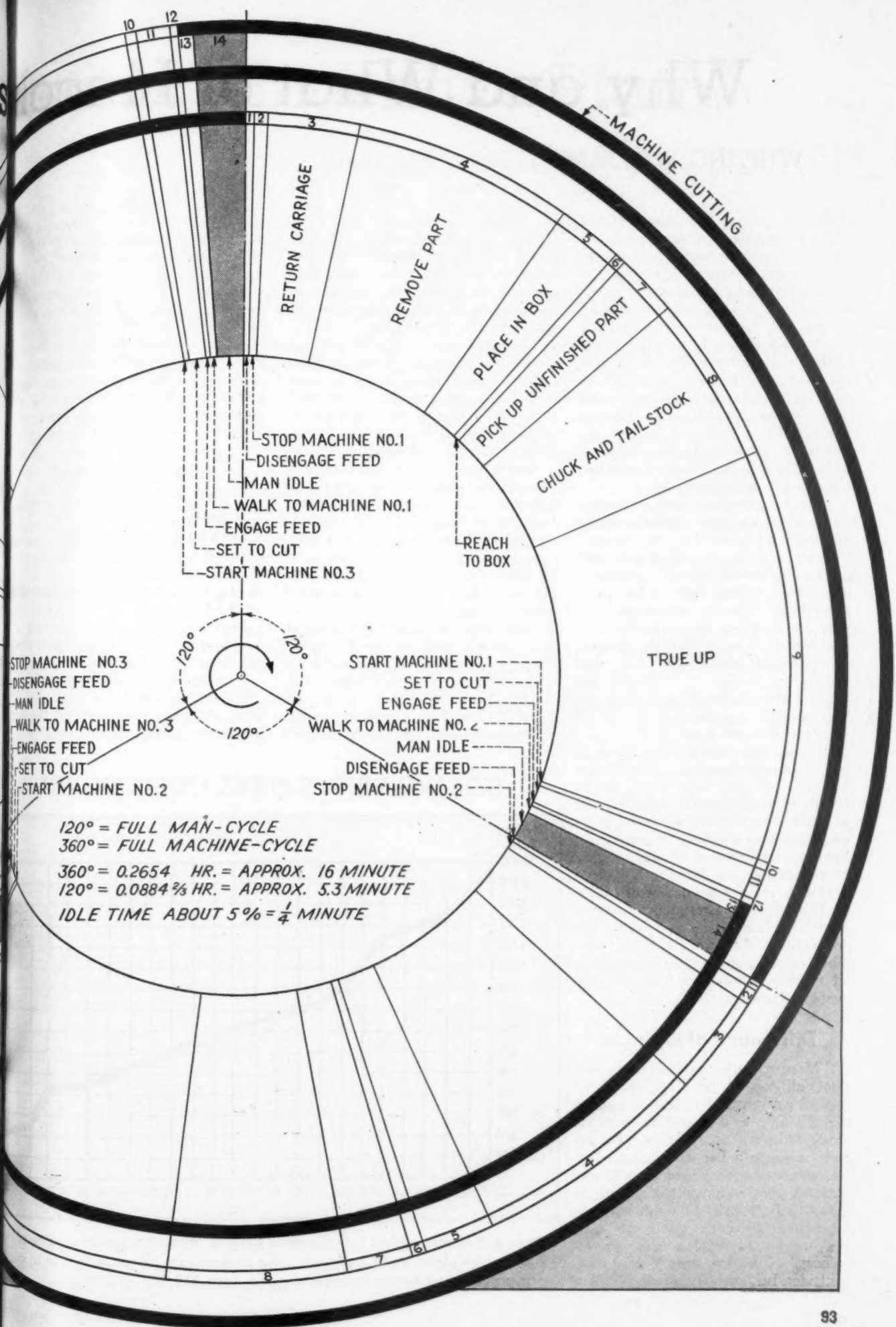
$$\text{Percent idle time} = \frac{0.0037}{0.0885} = 4.2\%$$

This is probably enough to cover minor delays, contingencies, etc., and a short relaxation period, theoretically about 15 seconds between machines

But it is not enough for the entire day. According to Alford, studies indicate 10 to 12%

So the operator will doubtless knock off about five or six times in 8 hours, for a smoke or drink or personal needs. This will kill 30 minutes a day, or more, which is, say 6, or 8% idle time added to relaxing time above (4%)

*Problem is set up as if man disengaged feed. If this is automatic, then 0.0005 is added to idle time, total, 0.0042 hours. If the machine also stops itself, idle time increases 0.0010, to a total of 0.0052 hours. With these additional periods of rest, the idle time is 5 to 6% — about half enough


MACHINE CUTTING
RETURN CARRIAGE
REMOVE PART
PLACE IN BOX
PICK UP UNFINISHED PART
CHUCK AND TAILSTOCK
TRUE UP
STOP MACHINE NO.1
DISENGAGE FEED
MAN IDLE
WALK TO MACHINE NO.1
ENGAGE FEED
SET TO CUT
START MACHINE NO.3
REACH TO BOX
120°
120°
120°
STOP MACHINE NO.3
DISENGAGE FEED
MAN IDLE
WALK TO MACHINE NO. 3
ENGAGE FEED
SET TO CUT
START MACHINE NO.2
START MACHINE NO.1
SET TO CUT
ENGAGE FEED
WALK TO MACHINE NO. 2
MAN IDLE
DISENGAGE FEED
STOP MACHINE NO.2
120° = FULL MAN-CYCLE
360° = FULL MACHINE-CYCLE
360° = 0.2654 HR. = APPROX. 16 MINUTE
120° = 0.0884 ⅔ HR. = APPROX. 5.3 MINUTE
IDLE TIME ABOUT 5% = ¼ MINUTE

Why and What of Lincol

WHITING WILLIAMS, Consulting Editor, *Factory*

"SHORTLY AFTER the House Naval Affairs Committee had me explain our nearly 30-years' experience with incentives, our books were gone over by the Federal Treasury's accountants. A little later, its local representative advised us that, in addition to our regular profits taxes, we would have to pay the further sum believed due if we had not paid our factory employees in 1941 an annual wage averaging around $5000. This penalty was put at $1,600,000!"

This is what James F. Lincoln, president of the Lincoln Electric Company, Cleveland, told me recently.

"Our records show that ever since 1914, when we were regularly raising our total wages to their '41 average, we were as regularly cutting costs and passing the benefits along to customers and public in the form of big price reductions," Lincoln continued. "To date we have had no explanation of the penalty, except that the government appears to be convinced that no factory worker can possibly be worth $5000. Hence it figures that our only purpose in paying him that much has been to evade taxes.

"During our various discussions I have asked this question: 'Suppose we had paid the same total wages, not to our thousand employees, but, instead, to 3500—the number which our nearest competitor employs for producing the same total output. Would we then be required to pay this sum?' Believe it or not, I was assured that of course in that case no assessment whatever would be made! Can you blame me for figuring that we are being punished for having freed for other kinds of needed war work a total of 2500 first-class producers?

Difference of Opinion

"More recently, we have been told that all would be forgiven if we would pay, instead of the calculated $1,600,000, a compromise sum of $800,000. We are refusing. To pay even a single dollar would mean that we admit all our years of thought and practice about cooperation and incentives to be wrong. Our difference of opinion is still under discussion."

Government regulations forbid tax officers' explaining their *Why* to any outsider. But anybody is free to look at the *What* of it all—the events and figures shown those officers for indicating just how Lincoln's costs and prices went down as his wages went up while, as a young ex-footballer, he had tried to help his organization perform like a seasoned team.

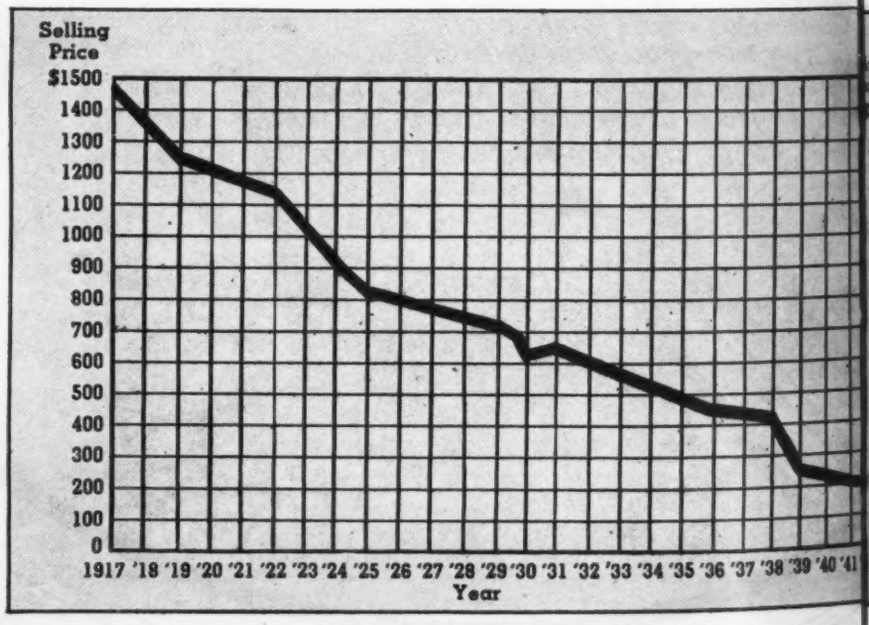
The whole thing started back in 1914 when the illness of his manager-brother forced Jim Lincoln to come in from his seven years of salesman's travel and take over the outfit. Up to that moment, all he knew about running machinery had been learned on a farm. So it looked like a good idea to contrive some way of getting his fellow-workers to contribute all they had learned by personal experience in the plant. Accordingly, he had every department elect its representative to sit down on an advisory board with him, his plant superintendent, and a foreman chosen by all foremen. (One member steps out and lets another in each month. Nobody can be chosen without having had a year's service or without a year's break between yearly terms.) Every two weeks or so since then, this board has exercised "authority over all matters affecting the men and plant operations." (Regular directors are company officers plus one semi-outsider, its legal counsel.)

It looks as if this board has had on hand quite a lot of the practical know-how its new, green chairman was after. Within the year it shortened hours and raised wages, both by roughly 10 percent. It also installed the system of setting and maintaining piece rates under which, doubtless because of certain unusual tests and guaranties, almost all employees still work.

Blazing the Trail

Less than a year later it installed free life insurance for a year's wages up to $2000. In 1918 it began a bonus plan which was superseded by the present improved model in '34. In '23 it helped blaze the now familiar trail of paid vacations. In 1925 came the selling of stock to any employee of more than one year. Today plant workers hold 30 percent of it and other employees almost all the rest. In '29 this was followed by a suggestion system which pays one-half of the first year's net savings. In '36 came an an-

SELLING PRICES HAVE COME DOWN . . .



Over a 25-year period Lincoln was able to drop the selling price of its 200-amp. welder by 87 percent. One clue to low prices is found in company productivity per worker—more than $19,000 in 1940

Electric's Incentive Plan

nuity retirement plan, and in '41 a trust or savings fund.

It is easy to picture the joyous, confident grin with which a union organizer would hand over to his prospects such a list of employee gains obtained. But, especially in the absence of any union whatever in the Lincoln plant, it is worth mentioning that the whole problem and future of unions would certainly be vastly different if they would always try to support similar employee gains with such a list of customer gains as Lincoln credits to the teamwork which his advisory board contrived to perfect.

Thus, according to the charts, while average annual wages were climbing from $2000 in '29 to nearly $5500 in '42, the customer was benefiting from a gradual but continuous slide down the price hill from $1500 for a certain standard machine in 1917 to $200 since '41. Also from a little over 15 cents per pound for a No. 5 electrode in '31 to a shade under 5½ cents since '41.

Meanwhile, of course, the departments of research and of engineering responsible for new methods and equipment were hardly spending much time on the golf links. Fact is, they weren't even smoking—that's against both plant and office rules. Nevertheless, the advisory board's chairman believes the biggest reason for these amazing figures has been the willingness of his fellow-workers to play the game for cutting down the required man-hours, for instance, for making a ton of electrode from 97 to less than 3!

Naturally enough, all this is credited for the concern's progress from a business of about $700,000 in 1915 to $33,000,000 in '42 (about half of the country's, and a quarter of the world's, production in this field).

"We are today producing $28,000 of annual product value per employee as against the $7000 per employee of a certain large competitor. The chief reason is that every member of our team is personally concerned to get out both the most and the best. Beside giving us quality, this reduces the costs of supervision, of turnover, and every imaginable waste of time, motion, personnel, and material."

In spite of Uncle Sam's curiosity, it does look like an impressive demonstration of Rotary's belief that "he profits most who serves best." In Lincolnese this spells, quite simply, "intelligent selfishness."

"Our job," says Lincoln, "is to give our customers more and more of a better and better product at a lower and lower price. This will make it possible to give the worker and the stockholder a higher and higher return."

If this team, whatever its motivation, can run up such a score, what prevents others from doing likewise! What's the catch?

Well, for one thing, that kind of team, good as it is, requires a mighty able and imaginative captain.

Who Gets the Bonus

To be sure, the directors, not the advisory board, determine the total amount to be distributed in the annual bonus. The formula adopted long before the war called for $3,000,000 of '42's profits to be distributed among 1300, with 90 percent of this going to factory workers and 10 percent to management (including nothing of this for Jim or his brother John). But how much goes to each person—that's for "Captain" Lincoln to decide. Last year the average $2300 meant an individual range from $10 to $25,000. So this job alone would seem almost enough to explain why he puts in at his desk and in the plant considerably more than the 44 hours regularly worked by his team mates. The group's small turnover doubtless permits next year's correction of this year's errors. But he believes they are kept pretty low by these three guideposts:

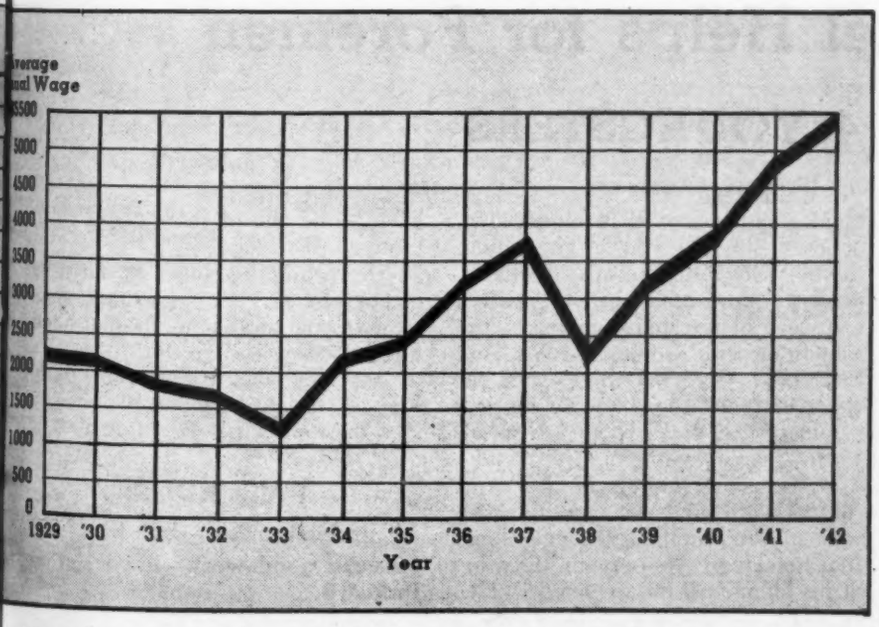
1. How good did the man's piecework earnings show him to be?

2. How long has he been around? If a long time, he must have accumulated a valuable lot of know-how.

3. What's his record—of attendance, of accidents, of cooperation, and of all-round usefulness?

The resultant sum is added to hourly rates similar to those current in the community and to piece rates set, but not limited, according to local levels; also to salaries believed distinctly below those paid by comparable concerns. For wage earners during the past several years this addition has meant an average of about 100 percent. Over the past ten years it has meant for everyone in the organization an addition averaging more than 50 percent. These average percentages the government evidently considers too high, especially for factory workers. But as between individuals, the captain must have done pretty well or his team would have called "Time-Out!" and shut down the plant

..WHILE ANNUAL WAGES HAVE GONE UP



While sales prices plummeted, annual wages climbed steadily (with understandable recessions in depression years) from an average of $2100 in 1929 to the extraordinary high of $5500 in the year just past

for at least one good argument—which hasn't ever happened or even been discussed! Lincoln is certain that the advisers will keep the team going long after he's finished. Nevertheless, it's a cinch that his successor, even with their help, will have to furnish an imposing combination of wisdom and confidence-inspiring squareness.

But what about the chance that the factory people will some day want to run the whole shebang—and throw management out?

"Several times," answers Lincoln, "I've asked the advisory group about such a management problem as, for instance, lowering prices in order to stimulate a sluggish market in slow times. But they only tell me that that's management's job, that their plant experience gives them no equipment for deciding any such matter."

But suppose the present 1300 grows to 5000 or 10,000? "That will only require," says Lincoln, "that the new assistant managers and the larger advisory board be 'experienced' into understanding and fairness."

But what if hard times threaten those annual bonuses? Or competition gets really tough?

To date, the first of these obstacles has always been overcome by lowering prices. In the worst of the thirties, hours had to be shortened but wages were not cut and nobody was laid off. As to the second—"Why should we worry so long as we keep our eye on the ball—the necessity, that is, of continuing the teamwork which enables us to produce three or four times as much per man-hour as do our nearest rivals?"

But what if these other chaps adopt similar methods and get similar results?

According to Lincoln, they can—but not without years of strenuous effort.

"The wage earner's fear of working himself out of his job," says Lincoln, "is so ingrained that, even with our plant board, it took us almost 20 years fully to convince our every man and woman that it was safe for him or her to go the limit—that piece rates meant what they said, that the more anybody produced the better off he'd be! Only this firm conviction, as finally gained by our longest-service people, made it possible for us to overcome this fear in the newer employees required by our increased business."

Obstacles to Efficiency

All who know anything about the wage earner know the depth, breadth, and intensity of this fear in his mind and soul. Born of his experience of the spiritual and economic misery of joblessness, it constitutes by far the greatest of all obstacles to the release of his full energies and hence to final industrial efficiency. Because its overcoming requires infinite understanding and patience, Jim Lincoln is right in believing that, in spite of all our numberless incentive plants, we have to date hardly scratched the surface of the possibilities latent in workers completely convinced that the more they produce, the more they'll benefit—without limit!

It is a sinister development that today, when some of our most noted national leaders plead in the name of Victory for such an outpouring of human effort as we have never known before, others of equal standing dismiss incentive pay as a wicked device for enabling one worker to take the bread out of another's mouth! Whatever the outcome of the government's probing, nothing is surer than that the level both of war costs and also of postwar living will depend upon our ability to do what Lincoln has done for more than a quarter of a century—find some way by which we can combine the highest imaginable wages with the lowest imaginable labor costs.

"We do not need," says Lincoln, "to fear big wages, short hours, or foreign competition. All we need to fear is governmental theorizing, sluggish imagination, and lack of cooperation between men and management. Eliminate these and there is no limit to what can be won by American ingenuity and American workmen. If in this conviction all of us here at the plant are wrong, and have been wrong for years, then further talk of 'scraping the bottom of our war manpower barrel,' of stimulating workers' effort, and of managerial striving for industrial efficiency, is nothing but bunk!"

Personnel Helps for Foremen

4. YOUNGSTERS

SURE. HE'S BEEN HIRED at a man's salary—expected to do a man's work. He might, too, if he's handled right. But—don't lose your common sense, brother—don't expect miracles.

He's not a man—he's a boy—a kid, that's all. Just a teen-age American youngster—with all a youngster's traits. A sober, responsible citizen? Is your son one? Or your kid brother?

Only day before yesterday he was out selling papers after school, to earn enough money to go to the movies Saturday. But today he's got something else on his mind. Something besides movies, or that blonde girl, or even the job you've given him, maybe. Down underneath, he's listening for a certain call—listening with a confusion of fear and eagerness. And something else—something he can't talk about—that has to do with the earth that was cool between his toes summertimes, down by the river. *His* earth—*his* state—*his* country.

He's seeing himself in the Army in Africa—in the Navy on a submarine—or maybe skimming through clouds in a streaking P-38—waggin' his wings at his blonde pal to say "hello." He's likely to be one of those places soon, brother. Too soon.

Meanwhile, he shirks, he flirts, he makes a lot of noise. Common sense is what you need now, brother—and understanding.

Any boy likes to be a big shot. Praise hangs on his mind like medals. But he's not disciplined—yet.

TWO RULES

Be understanding—but firm.
Reward good work—but insist on industry.

Contributed by LEE MARION, Middletown (Pa.) Air Depot

Organization and Control of Mass Production

EDWIN A. BOYAN *

The extensive beneficial effects of mass production upon the American pre-war standard of living are obvious. American mass production has reversed the direction of victory in the war. In the post-war period mass production will be essential in an economy that must provide a full complement of jobs for the national working force.

The principles of mass production cannot be applied in every factory. Neither is their application limited to the automobile industry. In the interests of our national welfare, they should be applied wherever they will be effective.

In order to show what is involved in mass production, and to determine the ways and means by which mass production can be established in specific cases, Massachusetts Institute of Technology inaugurated a research project under the direction of Prof. Erwin H. Schell, head of the Department of Business and Engineering Administration.

*Edwin A. Boyan was assigned initial responsibility for the research at MIT. However, he joined the staff of Wallace Clark & Company, management consultants, while the work was still in progress. Through the cooperation of that organization he was allowed to complete the preliminary research and prepare this report.

Organization and Control of Mass Production

MASS PRODUCTION is a challenge to any company that is not now operating by that method. Recent war experience has proved that, once production is under way, the techniques established by the mass production industries have achieved extraordinary results in the quantities of war matériel produced and the low costs attained. This fact extends itself into the post-war period when the scramble for a place in a highly competitive market will require that all companies attain the highest degree of efficiency possible and give serious consideration to the operating techniques they will use.

Fundamentally, the development of mass production requires (1) engineering ability that so establishes the production details of a product that its manufacture is facilitated, (2) technical skill that assures the promotion of efficient processing and tool designs, and (3) planning and managerial methods that integrate the many diverse activities necessary in preparing for and maintaining production.

Assuming that the necessary skills and methods will be available, the decision whether a company will undertake mass production of a product is likely to rest upon the following considerations:

1. What are the total quantities that are likely to be required?

2. Over what period of time will the product be in demand?

3. When must initial production be achieved?

A company must establish the *rate of production* that will be required, for mass production is predicated not so much upon the total quantities required as upon the quantities that are required over a unit period of time—i.e., per day, per week, or per month. Once a production line is established, conditions must be such that it operates steadily and uniformly and is not subject to abrupt changes in required quantities. Wide variations in production can be more readily handled if a company operates on a job shop basis.

The achievement of mass production then requires that a company establish and execute the following sequence of activities:

1. Production design critically to analyze the design of a product and to prepare clear and complete production drawings and specifications incorporating design changes and details that will expedite the manufacturing of a product without disturbing its functionability.

2. Materials and parts scheduling coupled with correct procurement and follow-up procedures to organize the flow of deliveries from supplies in coordination with manufacturing and assembly requirements.

3. Process engineering to select and to develop the most efficient operations available for the manufacture of a product

4. Planning and control of tool design and of procurement and installation of facilities to obtain orderly establishment of manufacturing operations and to meet specified dates for the starting of production

5. Development of a plant layout efficiently to locate equipment within the limitations imposed by process sequence and available floor space

6. Control of product and process changes to secure improvement in design, and reduction of costs with minimum disruption of production.

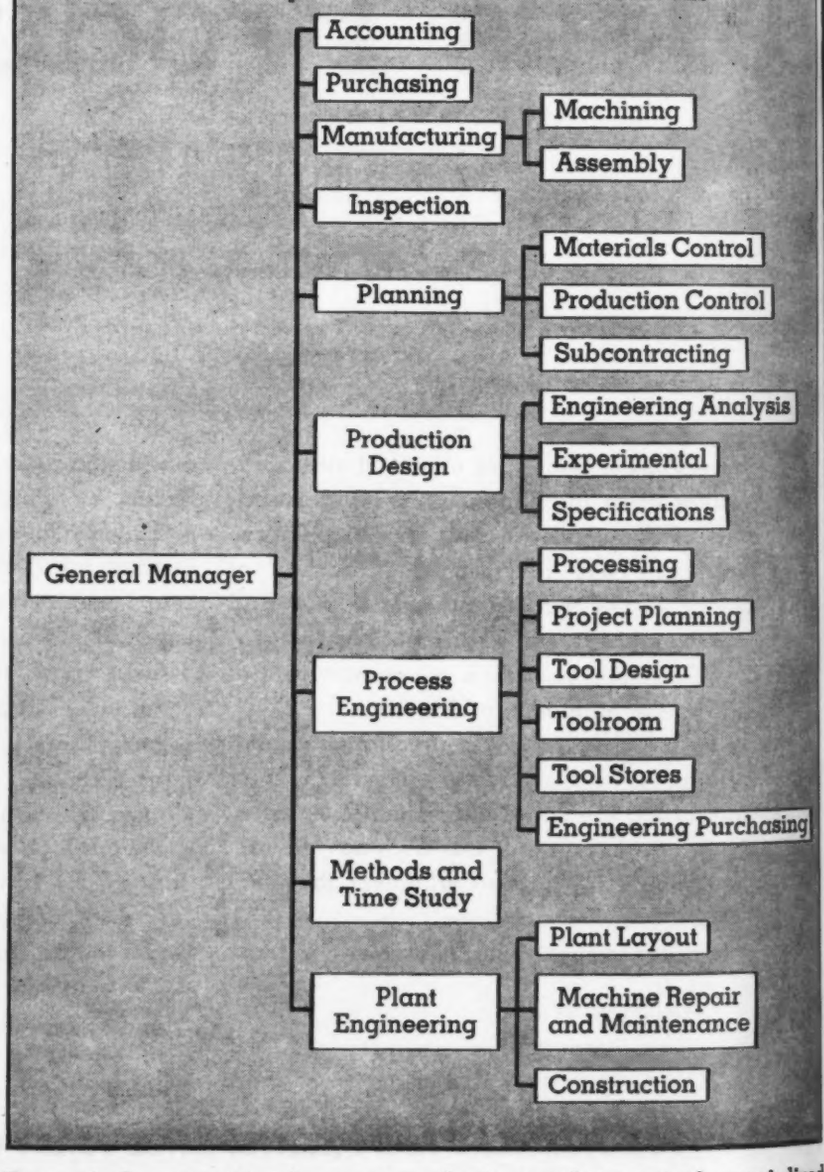


Figure 1. In organizing for mass production and its control, specialized groups assume distinct responsibilities

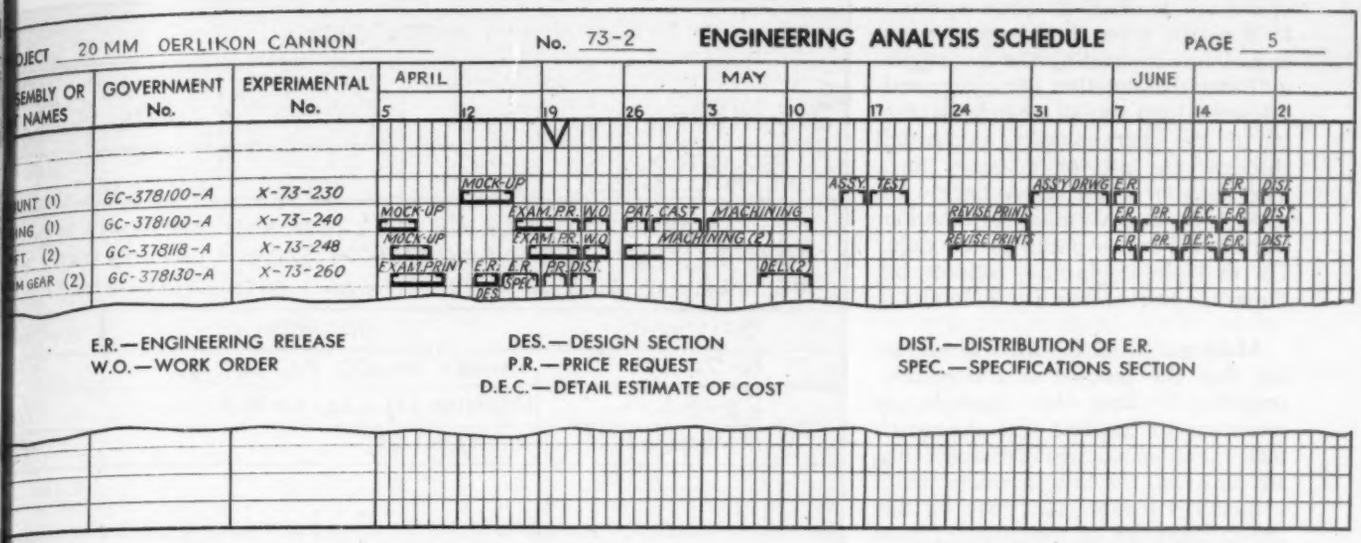


Figure 2. Gantt chart pictures the scheduling and progress of production design activities

The accomplishment of these activities calls for the assignment of definite responsibilities to specialized groups free to concentrate upon the particular problems that they must solve. These six activities are discussed in further detail in succeeding sections of this article. The general organizational set-up is shown in Figure 1 and represents functions usually required to set up and maintain mass production operating conditions.

Yet the activities of these specialized groups must be coordinated to a common objective—e.g., the need for the establishment, within a required period of time, of the necessary facilities to attain designated rates of production of a product of suitable quality. Thus top management is responsible for establishing an overall plan that specifies the time objectives for the accomplishment of each major organizational activity.[1]

1. Analyzing Product Design

Before a plant prepares to tool up for production or to purchase parts from outside suppliers, a critical analysis is made of the design of the product with a view towards establishing sensible tolerances, selecting proper materials, modifying the design for processing, using standard parts and elements, and providing complete and readily understandable specifications and dimensions. In other words, the product may often be specified in greater detail or redesigned to facilitate its mass production. Care is especially necessary to set tolerances that permit manufacture, yet assure the interchangeability and functionability of the product.

The sequence of steps generally related to this engineering analysis, or production design, as it is sometimes termed, is as follows, assuming that the product is not beyond the functional design stage—i.e., the product has passed only through research or developmental engineering:

1. Breakdown of the product into subassemblies, and subsequent breakdown of subassemblies into parts

2. Assignment of experimental numbers to subassemblies and parts

3. Scheduling of the production design department's activities

4. Production of a mock-up model

5. Examination of design prints and specifications towards the establishment of competent production drawings

6. Manufacture of a trial model to check the production drawings

7. Final revision and completion of production drawings

8. Formulation of decisions as to whether parts are to be manufactured by the company, or subcontracted

9. Preparation and issuance of engineering releases authorizing subcontracting of parts or the development and installation of production lines

Some of the above steps obviously will not be necessary if, for example, production drawings are available from other manufacturers, or if a trial model is on hand. However, some measure of production design must still take place to guard against the later use of incorrect or incomplete production drawings.

The first step, in any case, is to have on hand a complete parts list that itemizes each part entering assemblies. Later oversights may be prevented by using this list as a check to make sure that each part receives consideration in the various stages of production design, procurement, and assembly. An experimental number with an E- prefix may be assigned to each part at the discretion of the production design department. Until the experimental number is removed, no regular production or procurement of the part can take place.

Scheduling Production Design. Scheduling the activities of the production design department is well worth the effort, for lack of definite time limits in correlating each phase of this work may seriously delay the ultimate manufacture of the product. A Gantt Progress Chart (Figure 2) can be used to advantage.[2] To the left of the chart are listed the subassemblies and the parts of the subassemblies. Then the steps of analysis and action (later described) are scheduled for each item. An angle opening to the right indicates when a particular phase

[1] For further treatment of planning, see *Handbook of War Production*, E. A. Boyan, McGraw-Hill Book Company, New York, 1942.

[2] Many forms of control are used in mass production. In this article, Gantt charts are introduced for purposes of illustration, as they also picture relationships in the scheduling of activities that are otherwise difficult of description.

of work is to start; an angle opening to the left, when it is supposed to end. A line connecting the two angles indicates the duration. At designated intervals, represented by a V at the top of the chart, progress is charted through the use of a heavy line. The relation of the heavy lines with respect to the V indicates whether work is behind or ahead of schedule. For example, engineering activity on the worm gears is four days behind.

Making a Mock-Up Model. Assuming that the product is a large and complicated item—for example, a scout car or airplane assembly—and that functional design drawings only are on hand, the first step is to make a mock-up model. This may be the responsibility of an experimental section in the production design department. Parts of the final assembly are reproduced, generally in wood or sheet metal (1) to show whether assembly as specified on prints can take place, (2) to aid the engineers in the later interpretation of drawings and specifications and in the determination of possible improvements in design, (3) to forecast and obtain a clear concept of ultimate production difficulties, and (4) to serve as a model on which to check the effects of changes in design. Thus the mock-up model permits the translation of two-dimensional drawings into a three-dimensional object.

Examining Specifications. The initial designs may well have been made by designers or development engineers who are not thoroughly acquainted with processing methods, and who look at a product more from the functional than the manufacturing point of view. Often the specifications outlining the manufacture of a part—for example, cumulative and individual tolerances, degrees of finish, and types of cuts—can be revised later to reduce production difficulties and to make the product better adapted to fabrication by mass production techniques.

Furthermore, the manufacturing departments are furnished complete and accurate information in the form of production drawings by components. Such information should be clear and incapable of misinterpretation. In the event that a product is already being made by another organization and production drawings and specifications are available, these data must still be critically examined by the company engineers.

In view of the importance of this work, an experienced production design engineer is required. He becomes thoroughly familiar with the functional necessities of the product and the production processes that are available. Furthermore, he collaborates closely with the process and tool engineers to make sure that practical considerations govern the work done by the manufacturing divisions, and that all possible redesigns, within the purposes that the product must serve, have been made to speed manufacture.

Manufacturing a Trial Model. When a production design engineer believes that the production drawings and specifications for a part are complete, a work order (Figure 3) with a designated time objective for accomplishment is issued for the manufacture of one or more units from the material outlined in the specifications. If a part is relatively simple to manufacture, or will not affect the functioning of the final assembled product, steps may be immediately taken to procure or to make the item in quantity. Under any circumstances, machined samples of each part should be on hand by a definite date to

WORK ORDER

SERIAL	PRODUCT No.	ACCOUNT No.	DEPT. CHG.	FACT. WORK No. SUF.
534826	73-2	270	X-11	
REQUESTED BY	**OF DEPT.**	**FOR DEPT.**	**DATE**	**SUPT. L.G. E.**
D.L. WILLIAMS	ENG.	ENG.	APRIL 12	

TITLE CHARGE TO THIS ORDER ALL LABOR AND MATERIALS REQU
TO MAKE (2) X-73-380 BRACKETS FOR (1) 22 MM CANNON (TRIAL M
DELIVERY BY MAY 12TH PRIORITY AA-1 WITH PRECEDENCE B

DEPARTMENT	OPERATION	STARTIN
N-714A	MAKE WOOD PATTERN	4/
PV-83	FURNISH (2) STEEL CASTINGS CLASS 2	4/
M-400	MACHINE	4/

Figure 3. Work order authorizes the manufacture of parts for trial models, specifies sequence and starting dates of operations. As they are completed, direct labor and materials costs are accumulated

ENGINEERING RELEASE

PROJECT 20 MM CANNON PROJECT No. 73-2 PART No. K-31
DATE OF RELEASE 4/21/41 SUPERSEDES REL. No. _____ RELEASE No. 311

MODEL OR GROUP No.	No. REQ'D L.H.	N.	R.H.
K-31000		2	

FINDING OR NEXT ASSY DRWG: K-31300

PART NAME WORM GEAR
GROUP NAME GUN MOUNT
DRAWING DATE 4/9/41 REVISION DATE ____
MATERIAL SPEC. BRONZE
STOCK SIZE ____
ROUGH WEIGHT ____ EST. WEIGHT ____ ACTUAL WE
U. S. ARMY SPEC. ____ FEDERAL SPEC. ____
U. S. NAVY SPEC. ____ VENDOR SPEC. ____
SERVICE REQUIREMENTS ____
LINE-UP
PURCH AS K-31300 TO ARSENAL

REMARKS SEE GOVERNMENT SPECIFICATION GC-378130-A
LETTER No. ORD. L-85 APPROVED BY WERDEHOFF
EFFECTIVE JOB #1 DRAWING SIZE #1

Figure 4. An engineering release is prepared upon approval of design for manufacturing. It specifies engineering details, reference data, and manner in which part or subassembly is to be obtained, whether through purchase or manufacture by the company

permit assembly of one or more trial models. Issuance and follow-up of work orders can be undertaken by the experimental section.

The manufacture of parts for trial models is generally undertaken by the toolroom. Production departments should not be concerned with this work unless excess machine capacity is readily available. In some cases arrangements are made with an outside concern to make parts, particularly when toolroom facilities are loaded with regular work and the schedule for production of trial models is tight.

If possible, the process engineer and the tool designer who will be concerned with the establishment of manufacturing operations collaborate with the production design engineer in observing the manner in which the trial parts are made and assembled. In this way suggestions for changes and improvements in the component production drawings may be developed.

High initial costs are not an objection to the manufacture of trial models because these costs are outweighed by the following advantages:

1. Verification of the completeness and effectiveness of the production design in specifying exactly what the part should be

2. Check of the ease of assembly and the functionability of the product

3. Detection of possible shortcomings in design

4. Reduction of subsequent design changes and production difficulties in the establishment of manufacturing operations

5. Low rate of amortization in view of the many thousands of parts that may eventually be made under mass production conditions

6. If a company is operating under a contract, opportunity for submittal of trial models to the contractor for final approval

Final production drawings and specifications are drawn up by the engineering analysis section based upon conclusions reached through manufacture of satisfactory trial models. Subassembly drawings are prepared, and finally an engineering layout is drawn up to specify the design of the assembled product and the overall tolerances to be met. At this time experimental numbers are replaced by regular parts numbers.

Issuing Engineering Releases. An engineering release (Figure 4) is prepared for each part and subassembly approved for manufacture. The engineering analysis section specifies the engineering details—part name and number, grade or type of material, number of units required per assembly or subassembly, service requirements, and so on. The release, with copies of the respective production drawings and specifications, is forwarded to the specifications section. This unit may be set up as a part of the production design department, or sometimes independently, in view of its importance, as a department directly under the charge of the general manager.

The specifications section has the important task of deciding whether the part will be made by an outside supplier or by the company itself. Considerable judgment must be exercised and contacts with all members of the organization concerned with the establishment of production must be fostered. Two main criteria govern the determination of source—namely, price and time required for delivery, assuming, of course, that required quality will be obtained.

In cooperation with the process engineering, time study, and manufacturing personnel, an estimate is drawn up of (1) the tooling-up cost, (2) labor and overhead costs, and (3) material costs, to secure the probable cost of manufacture. In addition an estimate is made of the time required to reach full production. Figure 5 is

ESTIMATE OF TOOLING COST

DATE 6/12

PLANT SOUTH

NAME SHIELD-1/4" THICK ARMOR PART No. K-22100 PROJECT No. 73-2

EL No. NZ-2 QUANTITY REQUIREMENTS PER UNIT 1 UNITS PER 16 HOUR DAY 40 TOTAL UNITS 1000/MO

	OPERATION NAME AND MACHINE NAME	No. MACH. REQ'D	MACHINE FREIGHT & INSTALLATION	MOTOR & INSTALLATION	FIXTURES DIES & PATTERNS	SPECIAL TOOLS	GAGES	TOTAL COST
	SQUARE SHEAR SHAPE TO SIZE							
	SQUARE SHEAR	1	1000	200	250		10	1460
	FLAME CUT 2-3/8 X 67 NOTCH							
	#41 AIRCO TRAVAGRAPH	1	800*		50		20	870
	FLAME CUTTING MACHINE							
	REMOVE SLAG-BURR							
	PNEUMATIC CHIPPING HAMMER					125		
	ELECTRIC HAND GRINDER					75		200
	INSPECT						30	30
	*MACHINE ON HAND							
ED BY J.L. REED	TOTAL	2	1800	200	300	200	60	$2560

Figure 5. Estimate of tooling cost is made in cooperation with the process engineering, time study, and manufacturing personnel. It establishes probable increase in fixed assets and tooling expense

an estimate of tooling cost indicating the manner in which the cost of facilities (an important consideration in mass production) is computed.

A price request (Figure 6) is also forwarded to the purchasing department. Sometimes new sources of supply are recommended. The purchasing department communicates with the most suitable vendors, obtains quotations, and forwards the best quotation from a reputable vendor to the specifications section. This section compares costs and delivery times of the company itself with that of the vendor. By this means healthy competition between outside vendors and the company can be maintained, certainly with benefit to the latter, because progressive management thereby becomes an imperative. Other factors are also considered:

1. Although the price of the vendor may be slightly higher than that of the plant itself, greater overall efficiency in the manufacture of the final product may be obtained by subcontracting parts to specialist manufacturers with skill and facilities for the particular type of fabrication required. Experience has shown that higher efficiency is often gained by having a group of satellite plants forward parts to a central assembly plant than by having the major portion of the work done at the assembly point entirely. Too often there is a temptation within the company to utilize facilities that are obsolete, in need of conversion, or inefficient in comparison with facilities of outside suppliers.

2. High-cycle jobs where large quantities of parts can be made in a relatively short period of time generally should be allocated to outside vendors, in spite of a higher price, so that the main plant can be free to utilize its machinery on straight runs for other parts. There is little logic in delaying a valuable machine tool by setting up a variety of special jobs, when it can be operating continuously on the manufacture of one part. Thus the specifications section must look ahead with regard to other parts that will eventually be released for production. Furthermore it must solicit advice from the tool design section as to the length of time involved in tool design, procurement, and set-up.

3. Consideration has to be paid to the need for getting into production as quickly as possible. Oftentimes potential subcontractors will be unable to deliver by the required date, in which case it is up to the prime contractor's plant to manufacture a portion of the parts, and then, upon availability of subcontractors' facilities, immediately to reallocate the manufacture of parts to those plants. This has an additional advantage in that a dual source of supply is built to act as a safety measure. The resultant cost may be extremely high, but at least production is started.

4. In the receipt of bids the prices may be such that the specifications section suggests possible changes in design that will lower costs or prevent production tie-ups. This can be a good influence toward the designing of parts that can be produced at a reasonable cost.

Thus, on the basis of judgment tempered by data accumulated from several sources, the specifications section designates on each engineering release whether the part or subassembly is to be manufactured or purchased. If purchased, notations are made as to (1) whether that part is to be purchased individually or in assembly, (2) the point to which deliveries are to be made, (3) the state (rough, semi-finished, or finished) in which part is to be furnished, and (4) whether raw or in-process stock is to be furnished to the subcontractor.

If an item is to be manufactured by the company, or if stock is to be furnished to a subcontractor, a second important task of specifications is to specify on the release the type and size of stock from which the part will be made. Stock in turn is segregated into (1) *raw stock*—sheet, strip, billets, bars, pigs; (2) *in-process stock*—either rough or semi-finished—for example, castings, forgings. If raw stock is involved, a material specification sheet is also drawn up in collaboration with the stock section concerned with the handling of material inventories in order to select, if possible, a standardized size of stock. If in-process stock is required, prints, specifications, and an engineering release are drawn up and a decision is made whether it will be purchased from an outside supplier or produced by the company itself. Finally, an estimate is made of the number of pieces that can be made from a standard quantity of material, and of the scrap allowance that will be permitted.

Copies of each engineering release are then prepared and distributed. Authority is thus granted to procure a part from an outside supplier or to proceed with tooling for production within the plant.

2. Planning Flow of Materials

The planning department is the nerve center of a mass production plant and as such must assure the uniform and coordinated flow of materials and parts to points of production and assembly. Potential stoppages in production or deliveries must be foreseen and eliminated. Without complete pre-planning and follow-up, coupled with centralized control of the flow of materials and parts, true mass production cannot take place.

The general management establishes the basic overall schedule outlining the production requirements in terms of the final assembled product. From this point the planning department prepares detail schedules specifying (1) the necessary production requirements in terms of *component parts* to be produced and assembled in the plant, and (2) the required deliveries of *materials* and *incoming parts* from outside suppliers. The development of these detailed schedules does not guarantee that they will be met. Thus the planning department is also responsible for the maintenance of continuous follow-up (1) to check performance against the plans, and (2) to bring to the attention of proper authorities any delays that require attention and action.

Planning Plant Production. The production control section receives engineering releases and proceeds to schedule the requirements for parts and assemblies assigned to the company's facilities. A Gantt progress chart (Figure 7A) can be used effectively for graphical representation of a company's planned and actual progress. The advantages are these:

1. "Work planned and work done are shown in the same spaces in relation to each other and in relation to time

2. "It emphasizes the reasons why performance falls short and thus fixes the responsibility for the success or failure of a plan."[1]

Referring to Figure 7A, at the top of the chart is indicated the basic overall schedule for the manufacture of the final product—e.g., a 20-mm. Oerlikon cannon. Pilot lot production is take place over three months and is to be completed by

[1] Wallace Clark, *The Gantt Chart*, Sir Isaac Pitman & Sons, Ltd., London, 1938. For detailed description of the development and use of Gantt Charts, refer to this work or to E. A. Boyan, *"Handbook of War Production."*

PRICE REQUEST DATE 6/12

NAME SHIELD-¼" THICK ARMOR PART No. K-22100 PROJECT No. 73-2

No. NZ-2 START PRODUCTION 1/1/42 PRICE REQUIRED BY JONES

REQ'D PER UNIT 1 UNITS PER DAY 40 TOTAL UNITS 15,000

NTS DELIVERED TO M. WHEELOCK DATE 6/12

S MATERIAL TO BE FURNISHED

INFORMATION FROM PURCHASING DEPT.

RICE $4.00 RECOMMENDED VENDOR SIMPSON MFG. CO.

EQUIRED FOR PRODUCTION 3 MONTHS

EQUIRED FOR DELIVERY 5 MONTHS

EQUIRED FOR TOOLING 1 MONTH

F TOOLING $500.00 FOR FLAME CUTTING MACHINE

KS

Figure 6. Price request gets an outside supplier's quotation, helps determine whether or not a part or subassembly should be purchased

March 1. A month is allowed as a margin of safety for unforeseen delays, and full production of 1000 assemblies per month is to be achieved in the months starting with April. The planned times for production and assembly of parts are established in relation to this overall plan. For example, the machining of ten casings (K-31100) is to start on December 15 and is to be completed by January 6 in time to permit the subassembly of gun mounts (K-31000) by January 12.

As production and assembly take place, performance to the plan is indicated on the chart. As of June 1, pilot lot production had been achieved. However, the full production schedules are not being met. Only 70 percent of the final assembly requirements have been met in April and 90 percent in May, so that cumulative performance is 12 days behind schedule. Analyzing this condition further, the assembly of gun mounts is 9 days behind schedule. However, the manufacture of casings is 9 days ahead. Through the examination of charts of this type, immediate knowledge is obtained of the status of production and the extent to which elements are behind or ahead of schedule. On the basis of this information, necessary executive action may be directed to points of difficulty.

Scheduling Requirements for Incoming Materials and Parts. After plant production schedules have been established, the materials control section of the planning department develops schedules for the delivery of materials (Figure 7B). Initially to do this work, stock cards are maintained for each type and classification of material. In this way requirements for similar types of material used in the production of different parts can be assembled. Then a schedule is developed for the delivery of each category of required material.

Referring to Figure 7B, to the left of the chart are listed each type of material, the supplier, the buyer, and the person in charge of follow-up. The buyer is a member of the purchasing department and is charged with the locating of sources of supply and the awarding of contracts. The follow-up man is charged with the responsibility of seeing that deliveries of materials are made in accordance with established schedules and requests.

Based upon production schedules that have been set, the time and quantity requirements for material are specified. For example, 200 pounds of 2-in. round SAE 1112 bar stock will be required for the two-week period starting December 15. This figure is an estimate of the *actual* weight of material, including scrap losses, that will be used in the respective period.

A purchase request for each type of material is then issued to the buyer. This request specifies the quantity and time requirements for material. It is up to the buyer to obtain delivery promises that will provide a comfortable margin between the times that the material is delivered and is required for production. An order for total requirements is awarded to the chosen supplier. Then periodically vendor shipping releases will be forwarded to the supplier to indicate to him several months in advance *exactly* when the material is required and in what quantities. This latter procedure is followed to avoid crowding the storage facilities in the plant itself; yet a total order is initially given to a supplier so that he may be better able to plan and schedule his operations and, if need be, maintain some of the material in inventory pending release. Definite delivery promises are expected and received from the supplier and are charted by the materials control section (1) to show the quantities released, and (2) to indicate expected inventory.

For example, again referring to Figure 7B, the inventory of 2-in. round bar stock on hand as of December 15 is 500 pounds, as shown by the heavy dotted line.

A release has been issued for 4000 pounds, and the American Steel & Wire Company promises to deliver 500 pounds in the second half of December, 1000 pounds in the first half of January and 2500 pounds in the first half of February.

As material is received, the quantities are posted on the chart. Furthermore, since actual use of material is variable because of variations in production performance, a record is maintained of material usage. Thus an immediate visualization of the status of material procurement and potential and actual inventories is obtained.

The subcontracting section of the planning department operates in a similar manner as the materials control section. Requirements for parts from outside suppliers are scheduled, and promises and deliveries are recorded. Referring to Figure 7C, as of January 15, only 8 final assemblies have been completed. The Hercules Spring Company has fulfilled its promised delivery, but Barnes Manufacturing Company is behind schedule. The inventory of recoil springs on hand, however, will provide a coverage against actual needs of approximately two weeks into the future.

Procurement of Materials and Parts. Buyers in the purchasing department are classified according to the types of materials or parts they are to procure. Upon receipt of a purchase request a buyer becomes acquainted with the schedule that has to be met and secures materials, first, on the basis of delivery times required, and second, on the basis of price. Thus time, not price, initially determines the selection of the vendor.

The problem of getting an assured flow of the required materials and parts is difficult. But many of these difficulties can be eliminated by:

1. Planning of purchasing, whereby contracts are awarded within a speci-

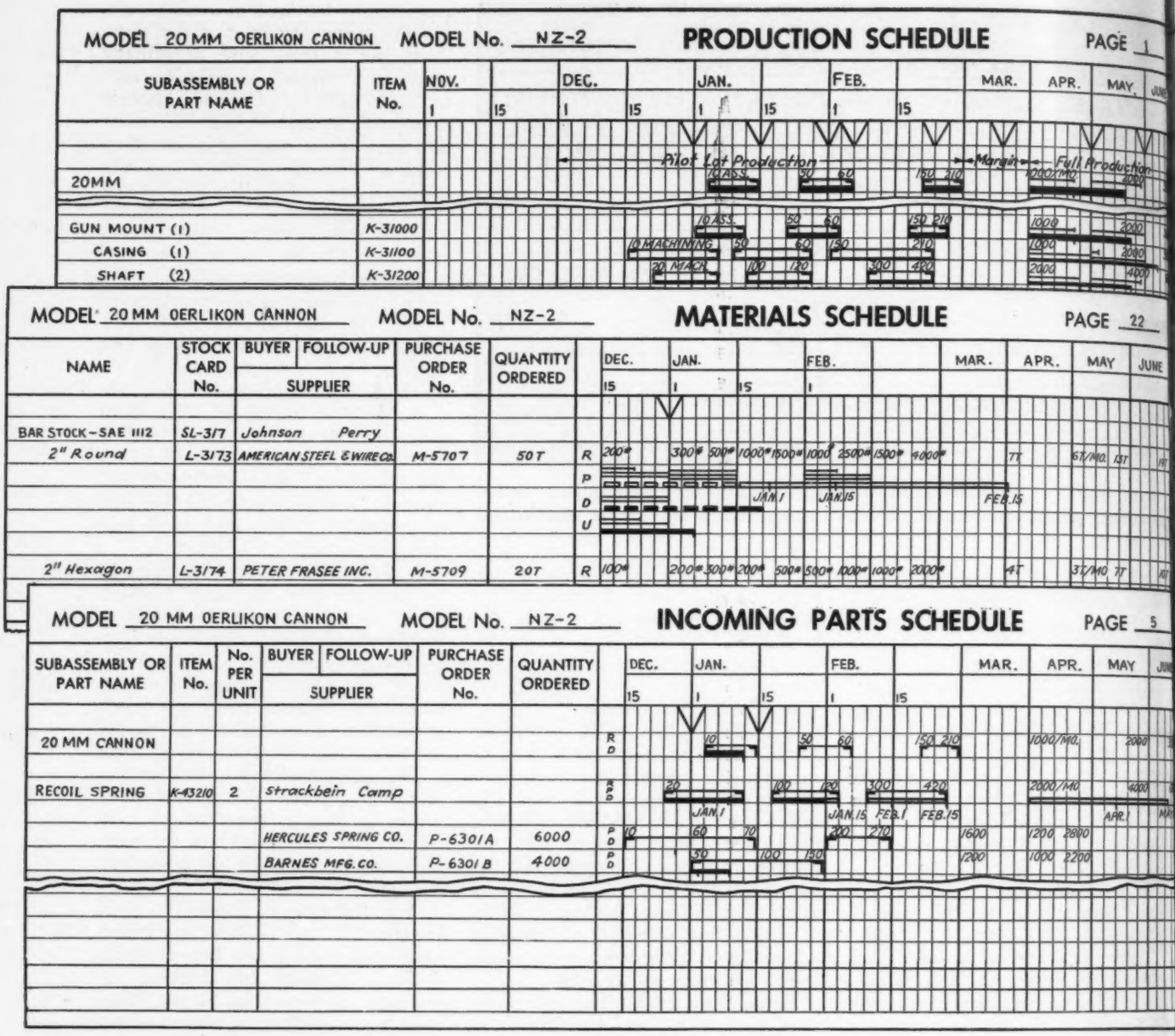


Figure 7A (top). Graphic presentation of planned and actual accomplishment in production of parts and assemblies. Detail requirements are related to the basic schedule for final assemblies set by general management . . . Figure 7B (middle). Materials schedule specifies requirements against which are posted suppliers' promises, deliveries, and actual usage in production. Immediate analysis can be made of actual and potential inventories . . . Figure 7C (bottom). Incoming parts schedule outlines time and quantity requirements for parts bought from outside suppliers, promised and actual deliveries

fied period of time for deliveries extending well into the future

2. Knowledge by buyers of prior services rendered by suppliers, their facilities and skills, and claims of other customers

3. Close collaboration between the supplier and the buyer in setting a schedule that is mutually favorable

4. Insertion of a detailed delivery schedule as an integral part of the contract

5. Immediate consideration and emergency adjustments by higher executive authority when a contract cannot be placed because of technical specifications, price limitations, or delivery requirements

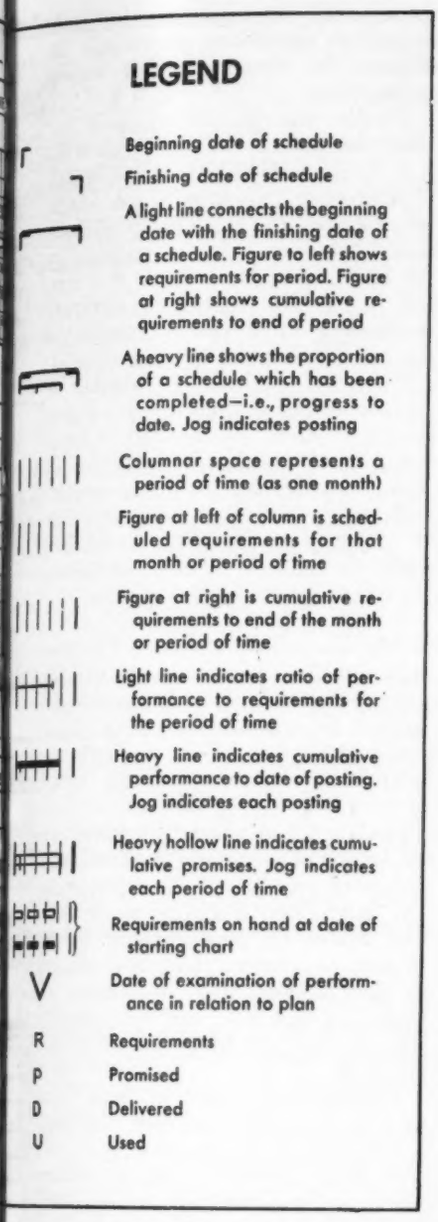
6. Organization of the purchasing department to include a central point where all necessary papers and documents can be processed in accordance with government regulations

7. Appointment of a liaison agent to maintain contacts with government officials and to foster necessary action in the securing of favorable ratings

8. Maintenance of accurate bills of materials and parts lists for ready reference on the part of the buyer. These lists and bills should be checked off to make certain that everything has been ordered, or is in the process of manufacture, as there may be oversights in forwarding authorizations and requests

9. Elimination of excessive paperwork by buyers and suppliers

Each buyer issues a purchase order to the selected supplier and advises the planning section that initiated


LEGEND
Beginning date of schedule
Finishing date of schedule
A light line connects the beginning date with the finishing date of a schedule. Figure to left shows requirements for period. Figure at right shows cumulative requirements to end of period
A heavy line shows the proportion of a schedule which has been completed—i.e., progress to date. Jog indicates posting
Columnar space represents a period of time (as one month)
Figure at left of column is scheduled requirements for that month or period of time
Figure at right is cumulative requirements to end of the month or period of time
Light line indicates ratio of performance to requirements for the period of time
Heavy line indicates cumulative performance to date of posting. Jog indicates each posting
Heavy hollow line indicates cumulative promises. Jog indicates each period of time
Requirements on hand at date of starting chart
Date of examination of performance in relation to plan
R Requirements
P Promised
D Delivered
U Used

the purchase request which supplier received the award and the delivery dates. This information is placed by the planning group on their charts.

Expediting and Follow-Up. Since mass production depends upon a steady input of materials, parts, and supplies, careful consideration is given to expediting and follow-up. But it is just as important to realize that expediting can be carried too far; firms that have consistently proved themselves in the past should be relied upon to deliver in the future. However, at the first indication of any possible delay, expediting should be immediately initiated to see what corrective measures need be taken.

Expediting, for the more critical items, starts when the order is placed. The practice of watching only the delivery of parts into a plant is often not sufficient. Physical delivery of an item is merely the last stage of expediting. Interim expediting is essential. It is necessary to observe when bills of material have been prepared, when tooling design has been completed, when parts and materials have been purchased, and when production has been started. Last, but not least, it is necessary to guard against parts or facilities being diverted elsewhere without sufficient reason.

Consequently a company appoints follow-up men for each classification of materials or parts and entrusts them with the responsibility of seeing that deliveries are made in accordance with the schedules that have been established. Furthermore, the classifications are so made that one follow-up man can be definitely assigned to one or a series of suppliers and work constantly with them so that he gets to know their practices and can aid them as much as possible. The practice of having several expediters come into a supplier's plant to follow their own particular products is not a good one. If a number of diverse items are concurrently purchased from one company, a single expediter should be assigned.

An expediter helps all he can. For example, he sees that the supplier gets the materials he requires. Many times the prime contractor can exert greater pressure on a subcontractor farther down the line than the subcontractor can do directly. In addition, if a supplier gets into difficulties and cannot deliver per schedule, the expediter may be able to arrange adjustments in schedules. The best safeguard against these difficulties is to have the expediter and the supplier sit down together and develop a schedule of the steps necessary to secure production.

Follow-up men are generally attached to the planning department, because (1) they must advise planning section heads directly on progress in delivery of incoming materials, and (2) they can become better versed in conditions at the final assembly point and better determine if adjustments in supplier's schedules may be recommended. However, any supplier that proves unsatisfactory must be called to the attention of the buyer who initially made the award.

The prime fact is observed that, once the schedule for the supply of a part or material is set, it must be maintained, and only changed at the direction of higher authority. Otherwise, the integration of the overall production program is jeopardized by one element getting out of line.

3. Selecting the Right Process

The responsibility for establishing operations for the manufacture of a product is assigned to the process engineering department. In addition to technical information, schedules are received which specify (1) the time objectives to be met in the manufacture of pilot lots and the achievement of full production, and (2) under conditions of full production, the number of product units to be manufactured per unit of time. This latter information influences in large measure the degree of specialization in the type of tooling that will be used.

The head of the process engineering department, in collaboration with the superintendent of the manufacturing division, determines the normal number of hours per day that the manufacturing division will work. It is difficult to achieve a completely uniform flow of material along a production line, therefore some leeway is provided to balance out loads on equipment. An excellent practice is the utilization of two 8- or 10-hour shifts. The remaining hours can be used for maintenance of equipment, plant housekeeping, development of new operating techniques, and resetting of tools after sharpening.

Duties of Process Engineer. For each part or subassembly a process engineer is assigned to the task of selecting and establishing the processing methods for its manufacture. Full duties consequently are:

1. Determination of the necessary fabricating, inspection and assembly operations, and their sequence one to the other

2. Decision as to the types and number of machines to be used

3. Selection of the necessary fixtures, tools, and gages required for each of the operations

4. Development of detail schedules for the procurement and setting-up of facilities

5. Supervision of the setting-up of facilities for each operation until satisfactory production is attained

6. Consideration, development, and establishment of any changes in product design or manufacturing methods that will facilitate production

The process engineer seeks to develop for each component part an operation list that specifies the sequence

and nature of operations for manufacture of the part and the types of machine tools or other basic equipment that will be required. From this point, he can prepare an operation detail sheet (Figure 8) for each operation. This sheet provides complete information for the establishment and maintenance of an operation through specifying (1) the nature of the operation and the tolerances to be met, (2) time standards and capacity, (3) quantity and description of required facilities—machine tools, fixtures, cutting tools, and gages—and (4) a historical record of the approved changes in product design or operating conditions from the time of initial set-up. In this manner ideas and conclusions on production techniques can be presented. These data will control in large measure future activities of the organization. During the production life of the project, any subsequent and acceptable revisions in production techniques will be immediately recorded on these sheets to keep them up to date.

Determination of Operations. The process engineer should have had the opportunity of collaborating in the development of production drawings. Furthermore, he should visit the plants that are already making the product (1) to study the operations and tooling set-ups in use, and (2) to learn the difficulties that are being encountered. However, he must guard against immediately adopting any production methods that he may see without first establishing in his own mind that it is the proper technique to follow. If speed is necessary in preparing for production, the procedures of another organization may be immediately adopted, but this practice should be the exception rather than the rule.

Consideration is first given to the stock that will be used, on the possibility that manufacture of the product can be simplified by change in the type or size of the original stock that is specified.

Next, the process engineer determines the series of cuts that will be made, recognizing the facilities that will generally be available and taking into consideration the degree of accuracy and the surface finish required. Visualization can be aided by having a trial part on hand. At this time he may discover where slight changes in the design of the product will secure economies in production. Approval of these changes is then obtained from the production design department.

The component production drawing received by the process engineer establishes a common location point or surface in each plane of the part, from which all other surfaces of the past are dimensioned. Thus the machining of location surfaces or establishment of location points takes place early in the operation sequence, so that the subsequent machining of all surfaces of a part may be related to a common denominator.

Finally, the series of cuts is so fixed that the complexity of machining and the amount of operator skill are reduced to a minimum. Against this is balanced the possibility of combining cuts to reduce the number of machines and tool set-ups needed.

Once the series of cuts is determined, the engineer illustrates the tooling set-up of each cut on operation detail sheets, Figure 8. The metal removal is shown by the shaded area. The dimensions to be met in making roughing cuts are set by the process engineer. Where finished cuts are made, the dimensions are taken from the production drawings.

The process engineer next proceeds with the determination of where inspection by the inspection department should take place. In this way inspection is treated as a series of operations absolutely essential to the manufacture of a product. And though the inspection department is not responsible for process decisions, its collaboration is necessary in the promotion of any processing that will assure quality.

A number of rules may be applied in selection of inspection operations:

1. Every cut should eventually be checked; but too many fabricating operations should not take place before inspection, as the possibility of catching and immediately correcting the source of the error becomes increasingly more difficult

2. The machining of location or other critical surfaces should be immediately followed by inspection

3. The degree of precision influences the location of inspection; for example, an inspection station can be placed at the end of all roughing operations but the number of intermediate inspection stations should be progressively increased as the part reaches a finished stage

4. Inspection should immediately follow an operation where the quality of a part is subject to controversy or cannot be positively assured by an operator because of the difficulty of measurement or the precision required

An operation detail sheet may be made, with modifications, for each inspection operation, particularly to diagram the dimensions that require gaging.

Finally, the process engineer decides the manner in which assembly is to be done. He has two alternatives —progressive assembly and fixed assembly. In the first, the product is assembled at a series of stations; in the latter, assembly is made at a central point. The controlling elements in deciding what type of assembly to use are (1) number of units of product per day required, (2) number of parts entering assembly, (3) degree of skill required, (4) number of functional tests specified, (5) degree of repair, modification, or fitting needed, and (6) ease and speed of assembly. If progressive assembly is decided upon, the process engineer establishes the necessary series of operations.

Machinery Requirements. The type and number of machines to use for each operation call for important decisions, because this element influences to a great degree the ultimate cost of the product and the speed in achieving quality production. Estimates of requirements are based on (1) types of operations involved, (2) degree of precision to be maintained, (3) production schedules to be met, (4) production times that can be expected, (5) future changes in design of the product, (6) machinery on hand and available, and (7) conversion or new machine costs that are involved.

Collaboration with machine tool manufacturers is advisable, for they can furnish much information on the type of machine to use and the operating conditions that can be expected. Furthermore, the process engineer investigates the possibility of subcontracting any extremely difficult operation to another company or organization that is better equipped in the way of skill and facilities.

As far as possible, machines that are already assets of the company are employed. A list should be available showing, first, unused or idle machines, and, second, machines that are only operating part time in the manufacture of products that can be readily subcontracted, if need be, to other companies. If any machines are to be converted, steps are immediately taken to prepare engineering drawings showing the extent of conversion.

If machines are to be purchased, the process engineer obtains estimates of delivery times from the machine manufacturers to see if they fall within the time objectives set for achieving full production. If certain machines

PART No. K-31040
MODEL No. NZ-2
OPER. No. 250
DEPT. No. M-11
PLANT SOUTH
DATE EFFECTIVE 7/26/41
DRAWN BY HMN:BP
APPROVED BY WARREN

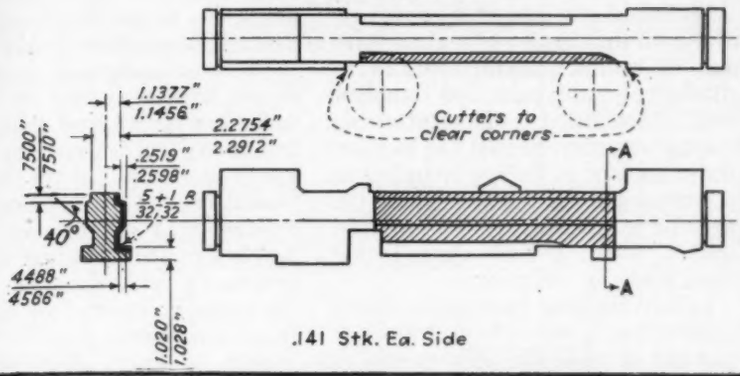
PART NAME BREECH CASING-20 MM OERLIKON CANNON
MATERIAL FORGING AXS-495
OPERATION NAME FORM MILL LEFT HAND SIDE-CENTER PORTION
EQUIPMENT NAME #4 K&T HORIZONTAL MILL 56285
#350 CINCINNATI MILL NUMBER 58325
SCHEDULE 1000 PER MO. 40 DAILY IN 16 HRS. HR. SCHED. 2.5

CAPACITY PER HR. PER MACH. 1.5
MACHINES REQUIRED 1.7

ACTUAL OPER. TIME	.420
ACTUAL SET-UP TIME	.120
TOTAL	.540
FEED PER MINUTE	2"
SPINDLE SPEED, R.P.M.	60

MADE BY LRB APPROVED MW

TOOLING SET-UP



.141 Stk. Ea. Side

No.	CHANGE NOTICE	DATE REVISED
36792	NEW CHANGE	8/5/42
39852	CANCEL	9/2/42
39901	NEW CHANGE	9/12/42

NUMBER REQUIRED	SYMBOL or TOOL No.	TOOL DESCRIPTION	NUMBER REQUIRED	GAGE No.	GAGE DESCRIPTION
2	F-13061	FIXTURE	2	G-25003	LOCATION GAGE (1.1377"/1.1456")
4	T-25010	FORM CUTTER-DETAIL #1	2	G-25010	FLUSH PIN GAGE (.2519"/.2598")
4	T-25020	CUTTER-DETAIL #2	2	G-25020	SNAP GAGE FOR 1.020"/1.028"
4	T-25030	CUTTER-DETAIL #3	3	G-25030	TEMPLET FOR 40° & FILLETS

Figure 8. Operation detail sheet indicates facility requirements to meet specified manufacturing conditions. As such, this sheet is a basic reference for establishment and maintenance of the operation

are not procurable, within time, he does not hesitate to re-analyze his estimate of machine requirements to see if some modifications and adaptations cannot be made.

Selection of Fixtures, Tools, and Gages. Under conditions of mass production, machines are so selected and set up that they usually remain on one operation. Exceptions are made when a machine is used for standby capacity or more than one operation, or when the total scheduled requirements of two or more operations can be easily satisfied by one machine.

Then the process engineer estimates fixture, tool, and gage requirements for each operation and enters the information on the respective operation detail sheet. A sufficient number of spare tools are calculated into the requirements to permit changes for resharpening and thus to avoid excessive shutdown of machines.

The next step is to determine the gages necessary for the assurance of a quality product. They may be divided into the following classifications:

1. Gages to assure the proper location of the tools in relation to the fixture

2. Gages to establish the proper location of a piece in a fixture

3. Gages to measure or control the travel of the work table or tool

4. Gages that are used by the production operators to check dimensions of pieces after machining

The process engineer works closely with the inspection department to see that his conclusions are correct and that the list of gages as drawn up meets the requirements for quality control. Collaboration is particularly necessary in determining the best types of gages for checking the various dimensions.

The process engineer completes the necessary information on the detail operation sheets and then assigns operation numbers. For example, the first operation is designated as No. 10, the second as No. 20, and so on, so that, if any new operations are instituted, new two-digit numbers may be readily inserted. Finally, numbers are assigned to the required machines, fixtures, tools, and gages. Later on these numbers will be marked on the respective facilities.

The head of the process engineering department approves each operation as set up by the process engineer. An estimate of the tooling-up costs is made, and the estimated production times are checked. Then a staff assistant may analyze whether the costs involved are allowable within the financial program that has been established. Finally, if approval is granted, drawing accounts are authorized so that the purchase of the necessary equipment can be started.

4. Scheduling Installations

The process engineer establishes a schedule (Figure 9) for each operation, specifying the time objectives that are to be met for the procurement and installation of machines; design, procurement, and installation of fixtures, tools, and gages; assignment of labor to install and operate facilities.

The planned time for these detailed activities must be related to the overall schedules that have been set for the manufacture of pilot lots. The process engineer is assisted in this

work by a representative of the planning department who is well trained in the methods of scheduling projects. Progress in the execution of planned elements can also be followed up by this man, providing him with such assistants as are necessary.

By this means the activities of a large number of individuals concerned with the establishment and proof of manufacturing operations can be effectively coordinated to achieve satisfactory production within the available time permitted. Actual progress will constantly have to be checked against schedules, so that if there is a delay in the execution of any element of the program, attention can immediately be directed to this point for action towards the elimination of difficulties.

Scheduling the Procurement and Installation of Machines. The process engineer and his planning assistant schedule the delivery dates of the machines that are necessary for the operation. Check is made with the engineering purchasing section on the delivery promises that can be obtained. Often contact is made directly with the machine tool manufacturer, particularly if special machinery is required. At least one machine must arrive in time for the trial of fixtures, tools, and gages, and the manufacture of pilot lots to prove the processing methods. Then the remaining machines can be scheduled for delivery within the time objectives established for getting into full production. If the engineer has originally specified standard types of machines for his operations, he obtains two scheduling advantages:

1. Delivery promises may be better than those of specialized machine tools

2. The machines may often be used interchangeably in the development of a pilot line

Many times the process engineer is unable to secure delivery of all required facilities within the time required. Thus he has to set up a line that operates on an interchangeable basis before he can get it on a fixed basis. For example, if a standard type of machine can be used on three different operations, the fixtures and tools for all these operations can be tried on this machine. Then, as successive machines come into the plant and are installed in the line, the number of interchangeable set-ups on the original machine can be reduced.

If machines on hand are to be converted, or if a special machine is to be procured, the time required for the preparation of design prints is scheduled. Upon completion of the design, it is submitted to the process engineer for approval. In addition to designing, planned times are set for the procurement of castings, motors, and controls, and for the machining and installation of parts.

The final element scheduled is the installation of the machines. This will then become the basis for the scheduling of tools, gages, and fixtures.

Machines are inspected upon arrival from the supplier to make certain that all contract requirements as to attachments and parts are complied with. Upon delivery of the machine, a layout engineer specifies the location of the machine in the line according to a prearranged floor plan. Then the machine is unloaded, placed on skids, erected, lined, leveled, cleaned, and made ready for operation.

In any machine installation care is taken to see that it is leveled properly and free of vibration. Also provisions are necessary to permit ready relocation should the layout be changed. Steel foundation blocks based on concrete are used effectively. In addition, upon instruction from the process engineer, all machine controls—for example, spindle reverses and rapid traverses—that are not necessary for the manufacture of a part will be disassembled. In this way a "green" operator will not disturb the set-up or cause any damage to the machine or tools by inadvertently moving the wrong lever.

As soon as machine procurement and installation is scheduled in detail for all operations, a summary schedule of delivery is drawn up for the total number of machines necessary for the manufacture of the product. The process engineer includes in this schedule the number of standby machines that must be on hand to take care of possible emergencies, resulting from the need for extra production or the failure to bring regular machines up to expected production in a reasonable length of time. These standby machines must be universal in character and tooled up to perform any one of several operations.

A purchase request is written for each machine that is to be procured. The head of the process engineering department approves the request and forwards it to an engineering purchasing section for the awarding of a contract to a machine tool manufacturer. Sometimes this section is located in the purchasing rather than process engineering department. If existing equipment is to be converted, the necessary authorizations are prepared for the work to be done.

Procurement, Design, and Installation of Accessories. Delivery schedules are established for the fixtures, tools, and gages required for each operation. The procedures followed are much the same as those used in determining machine deliveries. Again a sufficient number of items must be on hand to permit manufacture of pilot lots. Furthermore, designing, manufacturing, and installation must be scheduled. Finally, a summary schedule is drawn up to permit the issuance of purchase requests or work orders.

The process engineer, in scheduling, should have some idea of (1) which items will be procured from suppliers and which will be made by the company's toolroom, and (2) the approximate dates that can be promised. This requires close collaboration with the tool design, toolroom, and engineering purchasing sections. The toolroom, for example, knows how much work it can handle with regard to the manufacture of tools, gages, or fixtures. Sometimes the tool designer—who will design the original item—can express an opinion on whether it should be made in the toolroom, knowing the facilities and capabilities, or whether it should be made on the outside by one of the many specialist organizations that exist for this kind of work.

When designs for non-commercial gages and tools are required, the process engineer establishes—in conjunction with the tool design section—the dates when designs are to be started and the approximate length of time required for their completion. In this way the activities of tool designing are coordinated with the relative need of designs for procurement or manufacturing purposes. Planning is then carried further with regard to times required for the manufacture or delivery of tools, gages, and fixtures.

The process engineer should by all means possible seek to establish the procurement of at least one set of fixtures, tools, and gages for each operation in time to manufacture a pilot lot. There are advantages in so doing. Take gages for example. First, they can be tested functionally during the manufacture of a pilot lot. By this means the supplier can be advised immediately regarding any design changes that seem to be in order. Then he can proceed with the manufacture of the remaining gages, assured that they will not be returned for further machining. Second, where measurements are difficult to make, a gage immediately establishes the precision that is attained.

Upon completion of detail schedules for the design, procurement, and installation of tool, gage, and fixture

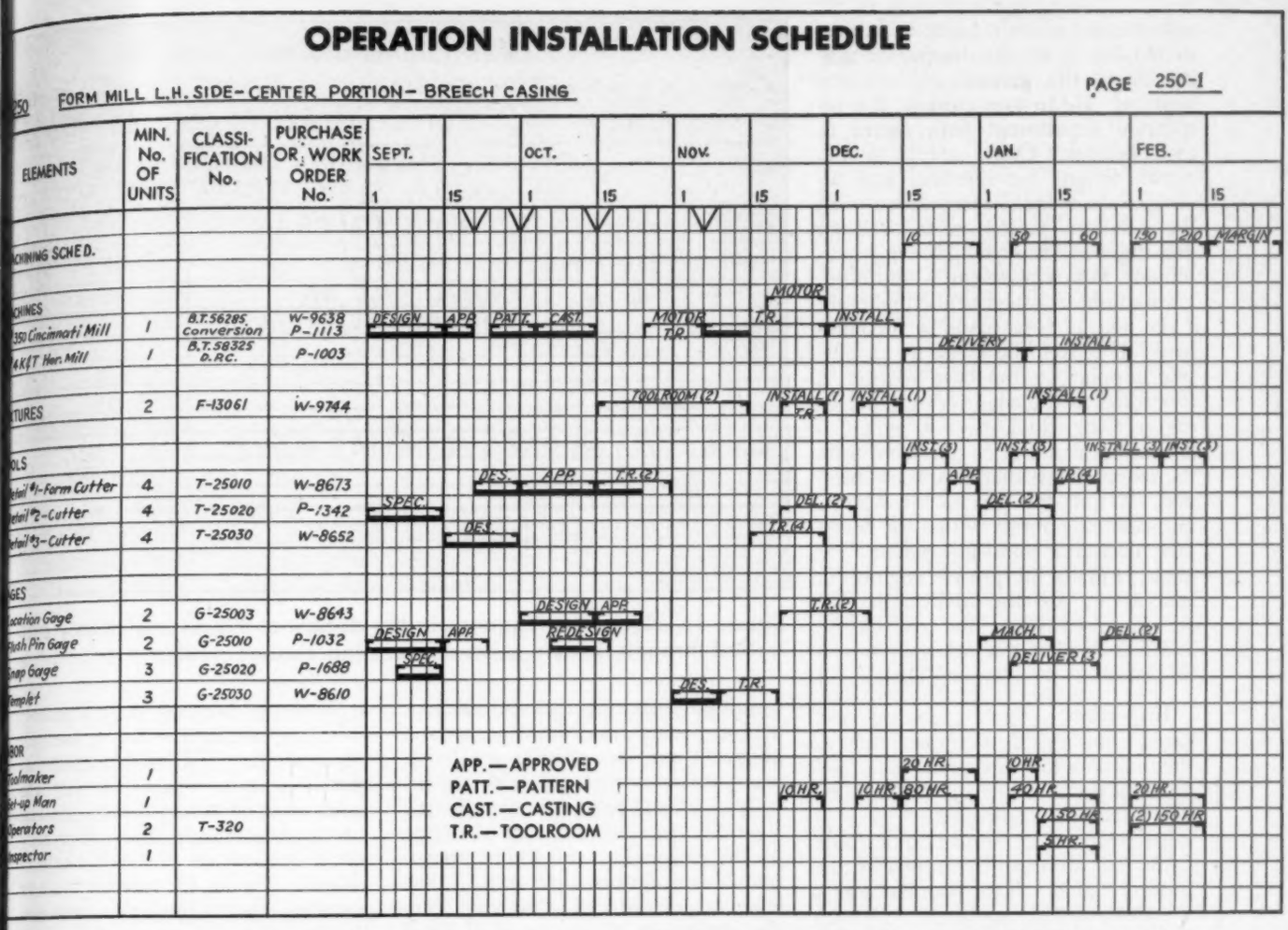


Figure 9. Operation installation schedule is used to establish time sequence for design, delivery or construction, and installation of facilities, and for the assignment of labor. For example, it will be noted that 20 hours of a toolmaker's time will be required in the latter half of December to install and insure the efficient operation of a set of three tools on a No. 350 Cincinnati milling machine

requirements for each operation, a summary schedule is prepared outlining delivery requirements for each type of accessory that is needed. Similar gages to be used by manufacturing and inspection are grouped together. These summary schedules also contain the number of items that will be necessary to act as possible replacements in case of damage or excessive wear. Mass production, as such, can be severely jeopardized by failure to plan the replacement of facilities anywhere along the production lines. The tool storeroom should be consulted to determine what may be considered an adequate replacement policy. Generally, on government work, only a 3-months' supply is maintained because of the changes in design that may take place. Ordinarily a 6-months' supply is maintained. Moreover, a close check on necessary replacements is later kept through the use of records showing the frequency of use and repair of tools and gages.

The program outlining the need for tools, gages, and fixtures is submitted to the head of the process engineering department for final approval. Purchase requests for commercial items are immediately issued. Non-commercial items call for rough sketches to be prepared by the process engineer and inspection department. These are sent along with authorizations for design to the tool design section.

Design of Fixtures, Tools, and Gages. Design of the fixture or work-holding device calls for the establishment of set-up blocks that will be used for locating (1) the position of the cutting tool with respect to the fixture, and (2) the position of the part in the fixture. The latter type of set-up block will be used in conjunction with an indicator to insure that the piece is correctly set in the fixture before it is machined. After the fixture design prints are made, wooden models may advantageously be constructed, better to visualize the effectiveness of the design. In tool design, the design engineer is careful to make sure that the tool will be sufficiently rigid for the type of cut that must be made.

Gage design calls for skill in determining the relation of the dimensions of the gage to the dimensions that are to be secured in the machining of a part. Gage dimensions are such that (1) provision is made for wear of the contact surfaces and (2) the use of the gage promotes cuts that represent lower limits of metal removal. Furthermore, gage construction is such that the gage is easily handled by relatively unskilled personnel, and yet will assure precise measurement. Careful design will prevent many arguments during production.

Above all the tool designer makes certain that the locating points used for gaging and for machining surfaces are identical to those shown on the component production drawings.

The tool designer then places a figure on what the probable costs of

manufacture of tools, gages, or fixtures should be. Then the designs are submitted to the process engineer for approval. He in turn consults the inspection department with regard to gage designs. Often many of the initial designs are rejected, and redesigns are made in accordance with the notations placed on the original drawings by the disapproving personnel. When a design is approved, a work order is issued to the toolroom, if the item is to be made by the company. If it is to be made by an outside supplier, a purchase request is forwarded to the engineering purchasing section, which tries to secure a delivery date and price consistent with the requirements that have been specified. If not, the process engineer is immediately notified so that the necessary decisions and adjustments are made. Finally the process engineer is advised as to the deliveries that are promised when the contract is awarded, so that this information can be placed on the planning charts.

Inspection. Tools, fixtures, and gages, upon arrival, go immediately to the toolroom for inspection. The toolroom has a schedule of the required deliveries and consequently can (1) initiate immediate inspection on those items that are urgently needed by the process engineer in the manufacture of the parts, and (2) advise the follow-up man of those items that have not been supplied within the promised delivery dates. This latter element provides an additional check on deliveries.

A tool inspection report is prepared for each group of items that is received. If the items are acceptable, they are sent to the tool storeroom for disposition upon proper presentation of requisitions. Record cards are initially established for each item so as to permit assembly of subsequent data on tool life and the amount of repair entailed in maintenance. Incidentally the storeroom should be careful separately to allocate and to keep gages used by manufacturing division and inspection department.

If an item fails to pass inspection, a decision is made as to whether it should be reworked by the toolroom or by the supplier, or whether it should be rejected completely. If the reworking is not necessitated by faulty design and specifications, the cost is generally charged to the supplier.

Installation. The installation of fixtures and tools is the joint responsibility of an experienced toolmaker and the process engineer. Both of them have to establish—in cooperation with the production department—the conditions that will represent efficient manufacturing. Stock for experimental purposes may be roughly machined parts obtained through work orders.

The effectiveness of the fixture should be based on the ease of setting up the part and on the rigidity that is maintained during machining. The efficiency of the tool is analyzed from the standpoint of the speed of travel and the accuracy of the cut that is attained. Sometimes the need for redesign becomes apparent. If so, a request for a tool engineering change is sent to the tool design section. A new drawing incorporating the change is then sent to the toolroom along with the corresponding tool or fixture requiring the modification. Sometimes, in the interest of speed, the toolroom may get the tool or fixture immediately with instructions as to the modification that is necessary. Then the tool design department is notified as to the changes that must be incorporated in the drawings. Of necessity, the tool designers continue to work closely with the process engineer and toolmaker in straightening out any production difficulties that may exist.

Scheduling Labor Requirements. This calls for a high degree of collaboration between the personnel department, time study and methods department, process engineer, inspection department, and the supervisors and foremen of the manufacturing division who will be in charge when production is established. The development and use of a schedule is particularly of great help to the personnel department, because it can proceed to make a careful selection in line with requirements and to establish an orderly transfer of employees. The helter-skelter transfer of men from one job to another, and the waiting for a job to get started can and should be avoided. Should there be an enforced period of idleness for some of the men, they can be assigned to the work of conversion and installation of equipment. Otherwise they may well be given classroom training.

Complete planning requires practical schedules of labor requirements within the following classifications:

1. Toolmakers and set-up men—to establish the proper operating conditions and to train personnel

2. Operators—to operate the progressively expanded facilities

3. Inspectors—to interpret quality and assure its maintenance

4. Other indirect labor, for example, supervisors, electricians, and millwrights—to assure the proper functioning and maintenance of facilities

Toolmakers and Set-Up Men. A toolmaker and the process engineer, as earlier explained, are responsible for installing tools and fixtures on a machine. During this initial set-up of a machine, a set-up man from the manufacturing division should be on hand to watch the manner in which it is done. This man will later be responsible for the continued operation of the machine.

While initial pilot lots are being

ENGINEERING CHANGE NOTICE

PART NAME BREECH CASING PART No. K-310

CHANGE NOTICE No. 39901 DATE 9/12/42 SUPERSEDES 39852

DETAIL OF CHANGE CHANGE DIMENSION ON FOOT FROM 1.020/1.0 TO 1.020/1.028"

REASON FOR CHANGE INCREASE TOLERANCE REQUESTED BY BELL

MODEL OR GROUP No.	LINE-UP	DISPOSITION OF M
NZ-2	MANUFACTURE IN DEPARTMENT M-11	No. ON HAND
		BALANCE
		USE
		SALVAGE
		REWORK
		AM'T SALVAGED
REMARKS SEE ORDNANCE LETTER #543		DATE SALVAGED
		CONDITION
		COST

EFFECTIVE IMMEDIATELY DRAWING SIZE #18

APPROVED BY WERDEH

Figure 10. Necessary changes in the design of a part are closely controlled through the use of an engineering change notice

OPERATION CHANGE REQUEST

10/23/42 DEPT. No. M-11 PART No. K-31040 OPER. No. 90-100

NAME BREECH CASING

DESCRIPTION OF OPER. FINISH MILL BOTTOM SIDES OF FRONT AND REAR FEET

MACHINE NAME & No. CINCINNATI MILLS # 167 AND # 169

PROPOSED CHANGE OPERATIONS # 90 AND # 100 ARE TO BE CHANGED FROM MILLING TO GRINDING OPERATIONS

REASON FOR CHANGE TO MEET CLOSER TOLERANCES

TOOLS AFFECTED NONE - EXCESS GRINDING CAPACITY AVAILABLE

MACH. AFFECTED REPLACE MILLING MACHINES WITH NORTON GRINDERS

COST AFFECTED TO CHECK INCREASE _____ DECREASE _____

EFFECTED 11/10/42 SIGNED SWP

APPROVED JLR Supt. OPER. RECORDED REJ

APPROVED REW APPROVED M W

Chief Process Engineer Supt. Time Study

Figure 11. Upon approval of an operation change request, action is initiated to revise and adjust the manufacturing conditions

manufactured, the set-up man is trained by the toolmaker. And both of them continue to work in conjunction with the process engineer toward bringing the machine up to a rated capacity through any improvements or changes of methods that become apparent. When the process engineer feels that the machine is operating satisfactorily, instructions are drawn up for its operation and maintenance. This will serve later as a guide in training operators. Then the time study and methods department is called in to set standard times.

Operators and Their Training. Schedules are set for the assignment of personnel to operate the progressively expanded facilities. At the same time the labor classification necessary for each operation is established. The process engineer has for reference a list that classifies and describes skills. For example, occupation T-280, tapper, is "one who operates tapping machine; this does not include tapping by hand." Similarly, T-290, turret lathe, "includes Warner & Swasey, Gisholt, Foster Libby screw machines and turret lathes."

Operators should gain as much experience as possible during the manufacture of pilot lots, so that when the date for achievement of full production is on hand, they can be operating at capacity. Experience furthermore can always be highly complemented by training. Set-up men are the logical choice for doing this training, particularly when they themselves have been trained in the proper teaching methods to be employed. Another advantage is that it is good practice to relieve the foreman of detailed training activities and to allow him to concentrate on the straight supervisory functions of assigning work to personnel and seeing that production is being secured through proper flow of materials, maintenance of tools and machines, and so on.

The training of an operator involves the explanation of two concurrent procedures—operation, or the maintenance of quantity production, and gaging, or the control of quality. Each operator is furnished with a diagram of the tooling set-up so that he knows the dimensions that must be maintained. He must be impressed from the beginning with the need for exercising care that assures the continuous production of a quality product. He is also given some idea of the production to be attained, but during the training and probationary period he should be expected to progress steadily, not hurriedly. After a fair rate of quality production is achieved, the operator is trained how to set up the machine during tool changes. It is difficult for a man to maintain interest in a job, if all he does is move a lever.

Inspectors. The inspection department is called in to aid in the scheduling of personnel that will be required for inspection. Gage deliveries are an important criterion; sometimes machines can be placed in operation, yet production gages for measuring the parts will not be on hand for some time. Consequently the measurement of dimensions may be a difficult matter—when temporary expedients are used—and may be beyond the capabilities of the operators. Thus well-trained inspectors will have to be constantly on hand to do this work, which in itself consumes more time than when regular gages are used. However, the inspection force may eventually be reduced as production gets under way, gages are delivered, and the production men become better versed in quality requirements and the methods of measurement.

Indirect Labor. To the minimum direct labor requirements for each operation are added the extra operating personnel that are necessary because of the danger of labor turnover, illness, or absenteeism. Furthermore, there is danger that production estimates established for certain operations may not be met, and consequently it is advisable to have extra men on hand that can balance out production at these points.

Then the superintendent of the manufacturing division estimates the indirect labor requirements for such functions as tool maintenance, repairs, storeskeeping, and records keeping. Furthermore the extent of supervisory personnel is estimated.

A master plan is finally drawn up of the direct or indirect labor requirements from the standpoint of (1) classification, (2) numbers needed, and (3) when assignments to the jobs should take place. This plan is sent to the personnel department so that personnel can be arranged for.

5. Developing a Plant Layout

An operation list is forwarded to a plant layout engineer who is responsible for (1) developing a floor plan of the raw and in-process material storage areas, machine locations, and required servicing facilities—tool storerooms, salvage cribs, inspection stations; and (2) specifying the necessary auxiliary equipment, such as hoists, hand trucks, and gage stands. This layout engineer may be a member of either the plant engineering, process engineering, or methods and time study department, depending upon the particular organizational set-up of a company.

First, the layout engineer makes templets representing the space requirements of each machine, inspection, and assembly station. Various

arrangements of these templets are then tried on a layout board to determine the best flow of material and the amount of space required. Good housekeeping is fostered by a presentable layout and adequate storage space, particularly to take care of temporarily large banks of materials which may arise because of lack of balance between operations or because of machine breakdowns.

Flow is so established that no backtracking of material takes place. If a progressive assembly line is used, the production lines for component parts are generally located, if possible, at right angles to the assembly line and at points where those parts enter into assembly. Safety is an important consideration; the layout engineer must see that adequate aisles and storage areas are laid out, so that the workmen will not run the risk of having materials fall upon them. Safety measures on the machines themselves are developed and installed by the process engineer. Incidentally, insurance companies can provide suggestions.

Added to the space requirements for storage and for operating stations are those for tool cribs, maintenance shops, parts repair sections, and salvage cribs. Crowded conditions in these areas should be avoided even at the cost of being unable to establish them centrally with respect to the activities they service.

Auxiliary Equipment. The specifying of auxiliary equipment—particularly for materials—is an important task. In any initial layout for a new product, elaborate materials handling techniques should be temporarily forgotten until uniform and satisfactory manufacturing methods and times are achieved.

Auxiliary equipment is also specified for the storage of tools and gages. A rule should be established that gages do not touch metal except in measurement. In this way, gages are less susceptible to being "knocked out" of adjustment. Wooden gage stands can be so designed that the gages are arranged in sequence; as the operator or inspector measures a part, the use of successive gages will assure that all necessary measurements have been checked.

Another consideration is the oftentimes highly specialized equipment that will be necessary for the maintenance of machinery. In these times, machine tools are getting a terrific amount of abuse through long operating hours and handling by relatively inexperienced personnel. Provisions must be made for periodic lubrication, cleaning, and repair.

6. Controlling Engineering Changes

Many changes in design and manufacture of a product are often necessary and arise from any of the following conditions:

1. Failure of the product design to achieve economical manufacture

2. Failure of equipment to achieve originally estimated capacity, thus throwing the line out of balance

3. Difficulties in controlling the quality of the product

4. Incorporation of suggestions by personnel

The control of changes and modifications is an extremely difficult task where mass production is involved. A straightforward procedure accompanied by the necessary degree of planning must be utilized to coordinate the many diverse elements of production that are affected by any engineering change.

Initiating Changes. A change in manufacturing may result from the process engineer receiving an engineering change notice (Figure 10) that specifies changes in design, manner of procurement, or type of raw or in-process material to use. Or he may receive from any one of several sources —methods and time study, toolroom, inspection, supervisors, set-up men, workmen, and so on—a notice recommending the elimination, combination, change of sequence, development, or simplification of an operation. Still another situation exists where the process engineer, after production has fairly well started, may himself see where an improvement may foster quality or simplify manufacturing. This latter condition particularly holds when the process engineer, because of lack of funds, time, toolroom facilities, or adequate assistance, was forced earlier to forego installation of production methods that would represent top refinement in manufacturing.

By having all recommendations channel through the process engineer, a central point is established for their control; and the authority for analyzing and executing the proposals is not widely dispersed over the entire organization.

Upon receipt of a proposal, the process engineer closely investigates the changes involved. This activity implies and requires close collaboration with other members of the organization—tool designers, production supervisors, production planners, design engineers, and so on. Particularly if a change in design is required, full acceptance of this change must be obtained (if an engineering change notice is not on hand) from the originators of the design.

When a change would be practical, or is required, an operation change request (Figure 11) is prepared and submitted to the chief process engineer and to the superintendent of the manufacturing division for approval. Upon acceptance, the process engineer is free to proceed with the installation of the new methods. If a change in the design or specifications of the product is required, the production design department revises the drawings and prepares an engineering change notice. The planning department in turn schedules the changes in production that will result, paying particular attention to the balancing out of production and the disposal of obsolete parts.

Installing Changes. The process engineer revises the operation list and the detail operation sheets for those operations that will be changed or modified. All data with regard to operating times, types of fixtures, tools, and gages, types of cuts, dimensions, and so on, must be kept up to date to represent positively the latest manufacturing practice. Any company, particularly in mass production, should have the details of product design and of processing both on paper and in the minds of its personnel.

Where the change is major, the process engineer prepares operation installation schedules for each affected operation specifying the time objectives that will have to be met in accomplishing the various steps—design and modification of equipment, reassignment of labor, new tool and gage deliveries, and so on—necessary to assure the installation of the new methods. This scheduling procedure has previously been described. The necessary work orders, purchase orders, and requests for tool engineering changes are issued. Follow-up is then carried out according to the schedules that have been developed.

* * *

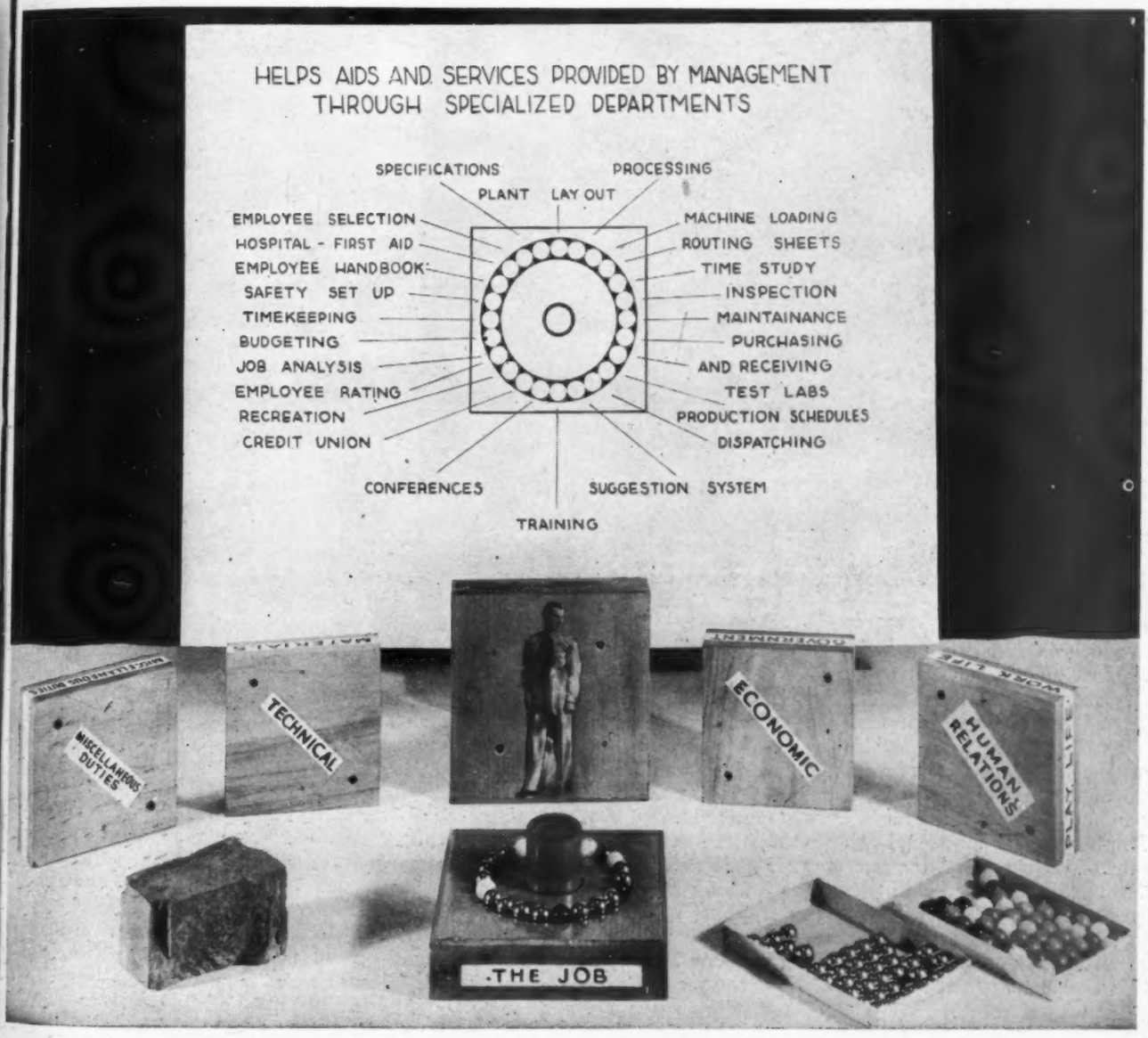
In conclusion, the establishment of mass production requires technical skill and ability coupled with positive planning and control to integrate the many diverse functions and activities that are involved.

Demonstrating to Foremen How Management Helps

ALLEGORICAL PRESENTATION and three-dimensional symbols distinguish a foreman training technique now in use at Servel, Inc., Evansville, Ind. Developed by Herbert W. Fillmore, educational director, it is one answer to the current problem of teaching the arts of supervision to the technically able machine hands who are being upgraded to the ranks of leadmen, assistants, and foremen.

Successful because it reduces the foreman and his job to a picture that can be quickly understood, the Fillmore plan is more than a method. It is an apparatus—consisting, first of all, of the six wooden blocks shown in the photograph directly below. The foundation block, symbolic of "the job," has a wooden pivot perpendicular to its center. The second block, symbolizing "the foreman," has a center hole corresponding to the pivot on the first. When the second block is placed on the first, they illustrate the relationship of the foreman and his job.

The remaining four blocks symbolize the foreman's responsibilities; they are slotted to fit one on top of another, all together being symbolic of the supervisional load he carries. Each side of each block, as



From the blocks and other properties displayed on table, Herbert W. Fillmore of Servel, Inc., builds the story of the foreman on his job. His presentation, described step by step in text and pictures on the following pages, has been used effectively as an opening gun in his foreman training course

we shall see, represents some fraction of the load.

In addition, there are ball bearings which fit into the race of "the job" block and are covered by a similar race on the bearing side of "the foreman" block. They represent the many aids and services provided by management to make it easier for the foreman to carry his heavy load and get around better on his job.

In the series of photographs shown on these two pages and the one next following, Fillmore himself demonstrates the nine steps he takes in teaching the fundamentals of foremanship. Direct quotations are digests of his explanatory remarks.

Step 1. As shown in the photograph on this page, the apparatus is set up on a table. The blocks stand on edge in plain view so that the labels can be easily read by members of the group. Groups are kept small enough so that the men can see everything that goes on. Fillmore faces the class, picks up the first block which, as we have seen, is marked "the job," and places it in a central position.

"You are now beginning your foremanship training," he says. "The first thing you need to have is a simple, specific idea of what your responsibilities as foremen are. To give you this idea, I have devised the set of blocks you see before you.

"The first block symbolizes 'the job,' and it is so marked. It stands for everything you men do out there in the shop. In the old days the foreman's job was a simple one. Today it has become far more difficult. And you men have become the key men in industry because you are really the non-coms – the corporals and the sergeants–who are going to be responsible for supervising and obtaining maximum war production."

Step 2. The demonstrator now picks up the second block which has a picture of a foreman pasted over its top. The center hole of this block, as already explained, fits over the pivot on the first. The demonstrator continues to talk:

"This block represents you, 'the foreman.' I place you on your job."

With that he places the block over the pivot and moves the top block around with his finger.

"You are supposed to go around on your job, to see that everything is running smoothly. This was quite easy in the old days. There was no mass production then, and your men had worked with you for years. Today many new responsibilities have been piled on your shoulders."

Step 3. At this point he picks up the third block, labeled "human relations," and fits it on top of the second as he talks:

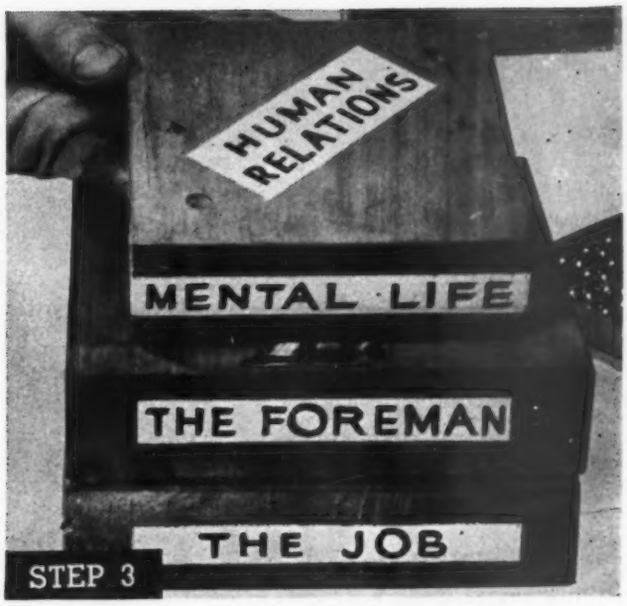
"For example, a good foreman must certainly know now how to handle people. Human relations is even more important to the supervisor than the knowledge of how to run machines. Unless the people you supervise are contented, healthy, and growing, they cannot do the best for themselves, for you, and for the company. You must know how to handle human relations so that you do your full part in making your employees (1) contented in their work, (2) happy in their home lives, (3) healthy in their play, and (4) mentally ambitious to further their talents and attain promotions.

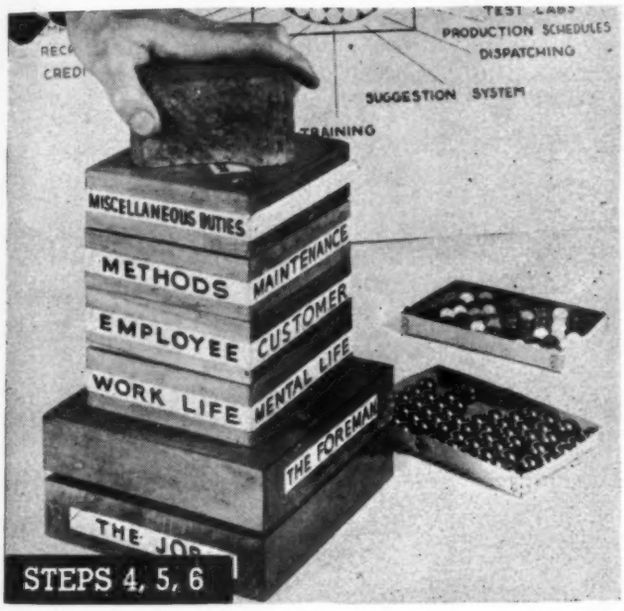
"The four sides of the block represent these four elements. If any of your employees are off register in any of them, you have not been as good a foreman as you can be or as they have the right to expect you to be. First of all, then, if you are to be a good foreman, it is necessary for you to be an honest, sincere, watchful, considerate, intelligent expert in human relations."

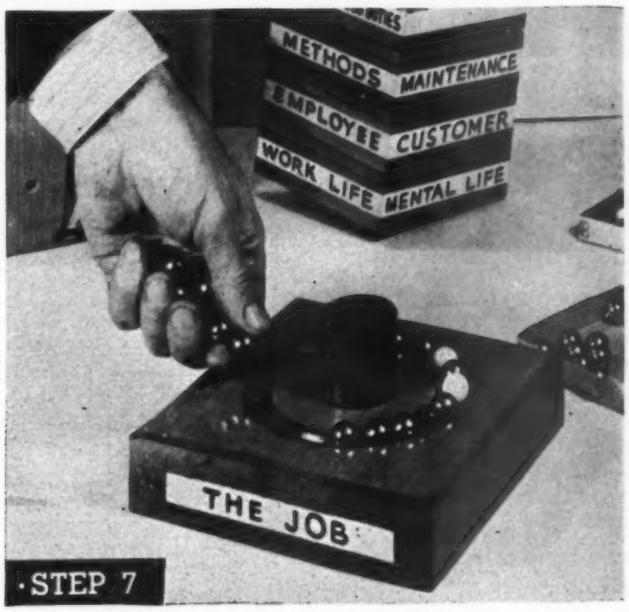
Step 4. The fourth block is labeled "technical." Fillmore picks it up, points his pencil to the subjects on its four sides, fits it upon the third block, continues:

"Good human relations is just one part of the load that you as foremen will have to shoulder. You must likewise be an expert in giving your employees technical training.

"Broadly speaking, this aspect of your job consists of training in (1) machines, to gain high production







rates; (2) materials, to keep scrap losses low; (3) methods, to keep efficiency rates high; (4) maintenance, to keep machines running and operation costs low."

He now moves "the foreman" block with its superimposed loads around on "the job" and says:

"You can see that with these responsibilities on your shoulders it is harder to get around on your job. You must be orderly. You must conserve time. You must be watchful so that you can anticipate difficulties and prevent their occurrence."

Step 5. Similarly, he picks up the next block, labeled "economic," and adds it to the pile, saying:

"A good employee needs to understand the facts of economics in relation to (1) markets, (2) money, (3) management, (4) merchandising. From this understanding comes faith, cooperation, pride, loyalty, zest for the job. Without them your supervisional job will be well-nigh impossible. You will be confronted with so many grievances, so much hidden defection, that it will be impossible for you to do your job right."

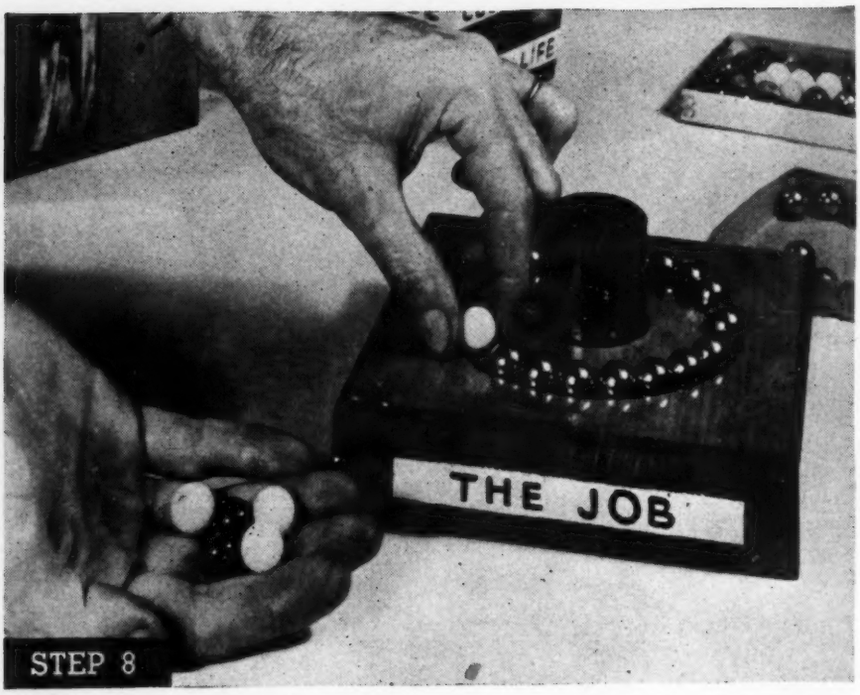
Step 6. Fillmore now picks up the block labeled "miscellaneous," places it on the "economic" block, and says:

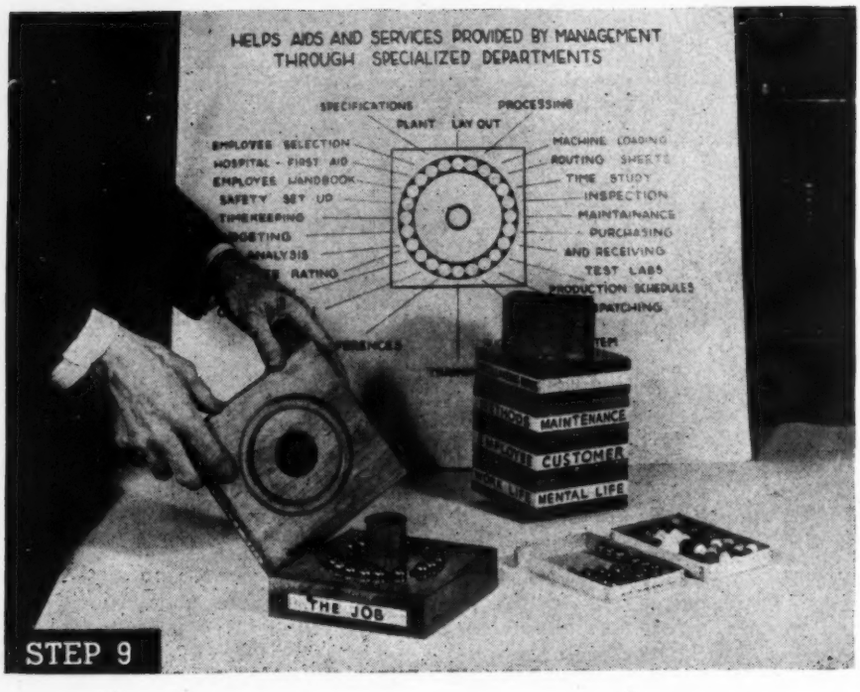
"There are countless miscellaneous functions that are vital—for example, these meetings and the home-study work that goes with them, superintendent's meetings, participation in various shop programs, supervising the unusual things that occur."

Then he places a common red brick on top of the pile and tries to turn the superstructure around on the foundation block as he explains:

"In addition to the heavy load you are already carrying, someone comes around almost every day in the week to ask you to sell tickets, arrange for a dance, take part in some drive, excuse some of your people for band practice, shift men to other hours so they can practice for the baseball team. These are all little things which we shall label 'dead weight.' You should not have to fool with them, but you do. They're part of the foreman's job."

Step 7. "So you see," says he, "you are loaded with responsibilities, especially in these wartimes, and it is mighty hard for you to get around on the job. Management recognizes all this, however, and is trying constantly to make it easier for you. It is supplying





you with aids that foremen never had before. If you had to perform without them, the job would be impossible."

Now he tears down the pile, picks up "the job" block, points to the race cut into the face, and takes a handful of steel ball bearings, with a few marbles mixed in.

"Management," he continues, "provides your job with many things to help you get around better. For example, foremen once had to keep time sheets. Management now supplies timekeepers, so that is a job you no longer have to worry about." As he explains, he drops in a steel ball or a marble, each symbolic of some specific management help.

"Similarly, as we shall discuss in detail in this course, management now provides drawings and specifications, plant layout, processing details, machine loading charts, routing sheets, time study, budgets, job analysis, employee rating, suggestion systems, employee selection, inspection, maintenance, purchasing and receiving, testing, production schedules, hospital and first aid, safety program, employee training, recreation. Management helps a lot with all these things which years ago a foreman had to do for himself. They make the going easier as you get around on the job."

Step 8. At this point he places the load back on the pivot, twirls it easily with his finger. But there is still a slight wobble because of the faulty marble bearings. Once more he removes the superstructure:

"It is a vital part of the foreman's job not only to know, understand, and use these management helps but also to be always on the alert to improve them. Examine every one. If you find some that are weak, ask management to fix them."

Fillmore now begins to pick a few marbles out of the race, throws them away, and substitutes perfect steel balls.

"Here, for example, is something wrong with time study, or job analysis, or inspection, or schedules. Prove to management that they are wrong. Throw them away. See to it that the right procedure is substituted. Management appreciates that kind of alertness in its foremen."

Step 9. Fillmore finally points out the race on the underside of "the foreman" block and says:

"Of course, you as a foreman have a bearing on this matter. Your attitude, aptitude, or personal fitness may need a little dressing up."

Unseen he places a little gum on the race just before he replaces the superstructure on the pivot. As he tries to rotate the pile, this little obstruction causes it to wobble, or gums up the bearings in the race, or something. He therefore removes "the foreman" block, points to the gum in the race and continues:

"This shows that, if there is something the matter with the foreman himself, the entire job can go to hell even though everything is organized right. The question to ask yourself constantly is, 'Do I need some dressing down?' Your job cannot run smoothly if you are wrong."

That ends the demonstration. It remains only for the leader to sum up with an admonition to the men to let the allegory of the blocks sink into their minds.

"Let this become a part of you," he concludes, "so that you grow to relate every detail of the job to this concept of your responsibilities. Judge yourselves in relation to these elements. Absorb the training details that are related to these functions. Watch every day for improvements that can be made. That will make you more efficient foremen as you get around on your job."

Do's and Don't's for Women

Cap that covers her hair, goggles, no jewelry, short sleeves—all combine to make a sensible and safe working costume

WITH THE ADVENT of women into aircraft manufacture by the thousands, Lockheed has mixed some good, sound advice in with the usual, as well as a few unusual, ideas for guarding the safety and health of all employees, male as well as female:

Health. Ration your food, but not your health. Take time out for breakfast, time out for lunch, time out for dinner.

Musts for every day: Plenty of greens; plenty of milk, fruits, "enriched" breads, and plenty of meat or its equivalent (if you can get it!).

Plenty of "yellows" in both fruits and vegetables. In other words, peaches are better than pears; yams are better than "spuds."

Sleep. Most important to your health and your job are sleep and relaxation. *Sleep is not rationed.* Eight hours is still the minimum, regardless of your shift.

Graveyard shift (12 midnight to 7 a.m.): Shut off the light by wearing eye shades. Shut out the noise by wearing ear plugs. Shut out the family by shutting the door.

Swing shift (4 p.m. to 12:30 a.m.): Eight hours of *continuous* sleep are better than mixing it up with your other activities in relays.

Day shift (7 a.m. to 3:30 p.m.): "Early to bed and early to rise, put plenty of sparkle in every girl's eyes."

Recreation. Don't ration your relaxation. Choose recreation that recreates. Suggested are such activities as bowling, dancing, tennis, badminton.

Do the job when on the job, but forget your work when you play.

Safety. *Hair:* All women working in factory areas must wear hair covering. Revolving machinery causes the same reaction as when you run a comb through your hair—static electricity causes your air to stand on end. Don't turn this war into a scalping party.

Ration your vanity and not your scalp. Use your head, save your hair.

Hands: You can keep your hands soft despite hard work. Twenty-five cent cotton gloves, worn while you sleep, and a good hand cream will work wonders.

Nails: Keep them short. Castor oil will keep them in good condition.

Clothes: Comfort, practicability, good taste.

Work shoes: Wear low-heeled, closed-toe, sure-footed shoes. Closed toes afford protection, and low heels reduce fatigue.

Dress: If your clothes require frequent laundering because of your type of work, it would be economical to choose sanforized material; otherwise, strutter cloth or any substantial material. Silks and rayons are definitely taboo. Simple and smartly tailored clothes cost no more and express good taste.

Blouses: The plain tailored blouse is always flattering. Form-fitting sweaters and "T" shirts are out, and no bare midriffs.

Girdles: By all means. You will look better, feel better, work better.

Jewelry: Wrist watches, earrings, necklaces, bracelets, and finger rings are extremely dangerous around moving machinery.

Any injury should be reported immediately. Lockheed has first aid stations throughout the factory at all plants. These are staffed by doctors, nurses, and first aid attendants, who give 24-hour service. In case of injury, report to your immediate supervisor, who will send you to the first aid unit or hospital for treatment. If you feel ill, report to your immediate supervisor, who will send you to the first aid unit for treatment.

Doctors are available at all times for advice concerning your health and well-being.

Eyes: Lockheed provides goggles for your protection. *Use them* if you work with drills, rivet guns, Cleco pliers, or any tool or machine that might send chips or sparks flying.

Lifting: By law, women in industry may not lift more than 25 pounds or carry more than 10 pounds up and down stairs. Don't.

If you need to lift, do it the right way. Size up the load before you lift it. Get help if necessary. Lift with your leg muscles, not with your back.

Please be seated: When stools are provided, please use them. Alternate sitting and standing positions. You will find that you will not be so tired at the end of the day.

Pregnancy. For your protection, pregnancies should be reported *immediately* to your women's counselor. Counselors are your friends and have your interests at heart. Information given them is *absolutely confidential.*

Within one week after you have reported pregnancy, your counselor must have a letter from your doctor stating (1) time of confinement, (2) how long you will be able to work.

Smoking. No smoking, please, in the restrooms. Smoke at specified rest hour periods in the zones nearest your department, and in the lunch areas at mealtime. See that cigarette butts get into a container.

Office workers may smoke at their desks if they are not doing work that requires meeting the public.

How Britain Inspires War Workers to Improve Output

FRED B. BARTON, War Correspondent

War Correspondent Barton boarded the Clipper for Britain with commissions from *Factory* for several articles. This is the first to be published. It was prepared from first-hand information obtained from the Admiralty and the Ministries of Supply and Production. It is illustrated with official British posters and photographs

THE JOB of keeping up worker morale in war-surrounded Britain is not left to chance or allowed to diminish, even with the sting of possible defeat turning to the certainty of eventual victory. It is being done by a corps of production-minded men and women at the Admiralty and the Ministries of Supply, Production, and Aircraft Production. Some of these people are American trained and understand sales promotion technique. Many of them have had factory experience.

They begin by refusing to look on their work as dull and routine. Getting the message across pungently and forcefully and without tiring their audience is an assignment as thrilling to them as a manhunt.

This wartime job of making the war seem real to factory workers is carried on in every British plant, large and small. There are no Willow Runs in the United Kingdom, because they would make too easy targets for enemy bombers. Instead, Britain has hundreds of small plants, some operating in old buildings, some hidden away in small towns, some buried in abandoned stone quarries.

Some of these plants are fairly sizable, employing from 30,000 to 40,000 hands. Others are very small—as small as 19 hands.

Some of the larger plants have their own relations staffs, well equipped to do the job of explaining the war job to employees. The government departments dealing in war production make no effort to dictate or control the type, quantity, or standards of display material these large plants hand out or post for their workers to read and ponder over. If a factory prefers to create its own publicity, that suits everybody. For smaller plants, however, the government departments do a complete job, and this is welcomed by plants that do not have the facilities to create impressive display material of their own.

Britain is somewhat gingerly tackling the new and revolutionary idea of bringing labor into partnership with management. Joint Production Committees—referred to familiarly as JPC's—are made up of equal representation from labor and management. This is a startling development, even in a war that accustoms us all to new and startling changes.

First set up in March, 1942, JPC's need not be used in factories employing fewer than 150 hands; even so, over 600 plants of this size in the engineering field alone now make use of them. Throughout Britain's engineering factories some 2,000,000 workers now are represented by more than 2000 labor-management committees.

Better Labor Relations

A government spokesman sums up the development of JPC's in this way:

"Back in the days of British 'defeats' in this war, factory workers were critical of factory management. They looked for weaknesses, and they found plenty. It is reasonable to say now that relations are fairly good. Pressure by the government on factories to start up Joint Production Committees has produced results. For one thing, it was democracy's way of letting tired and sometimes unreasonable people let off steam. All the younger factory managers are for the JPC idea.

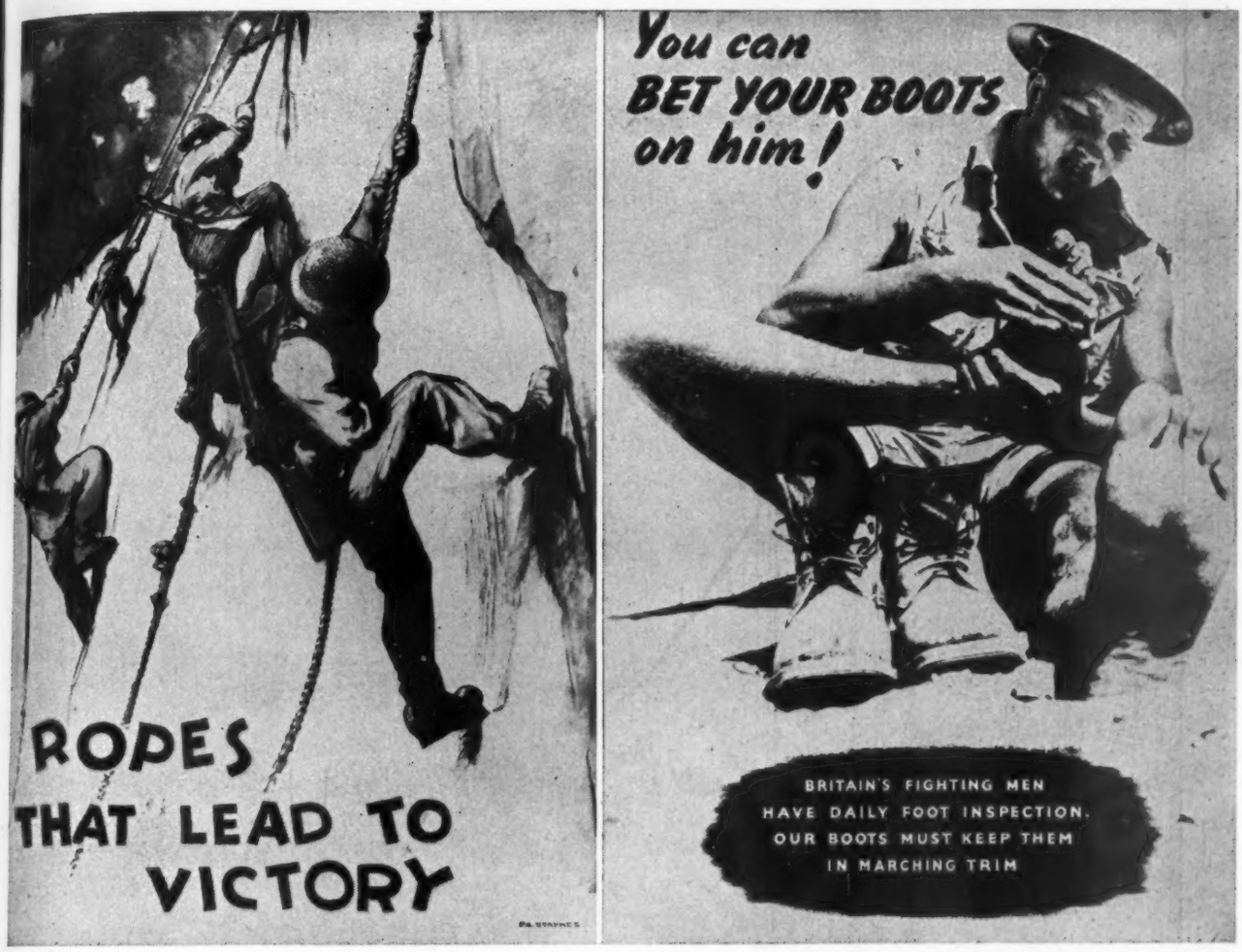
"There is some reluctance among the older factory bosses. Still, most factories regard the JPC as a useful talk-shop. Both sides get to know things they would not know otherwise. The whole idea is still in the experimental stage, and its usefulness varies tremendously from factory to factory.

"In every government factory the JPC is compulsory. There is a properly drawn constitution with the government stamp on it, and no personal idiosyncracies are allowed to interfere with its workings."

Doubtless both management and labor have been self-conscious and fearful and possibly inert in expressing their viewpoints in these joint management-labor meetings. The spectacle of youngsters, both men and girls, speaking up with a new and sometimes wild idea is enough to startle conservative England. But most forward-minded executives consider that the JPC's are here to stay, and want them to amount to something.

Now for the tools used in British war production drives. First, posters. They are vivid, handsome, and eye-catching. But even posters can lose their effect. The success of the British drive for production lies in the use of every variety of display material—posters, localized displays, bulletin-board newspapers, factory movies, music, and so on—plus a special effort to bring the war home to the factory workers. This last is often done by bringing returned war heroes to the factories, sometimes with the actual machine gun or airplane or whatever it was that that factory's product helped to make. Occasionally, too, selected workers from a war factory make a trip to an army base and see in actual operation the product they helped to make. When this is not possible, the usefulness of the product is brought home through pictures and dispatches. In other words, every effort is put forth to make the factory workers feel that they actually help equip the fighting men for victory.

Among the best and most useful



When the product has not changed to a wartime necessity, plant managers have to exercise ingenuity to bring home to workers that what they are making is as important to victory as ammunition

posters are a series of "battle" scenes with space for local imprint alongside. Here any factory can write or print a message saying in effect: "The gadget we turned out here helped win this victory." Any typical bulletin that seems important to the factory management gains added effectiveness when displayed alongside these newsworthy scenes of actual war.

Sometimes the product ties up neatly to some actual event in war. One placard shows a grinning soldier holding up some loaded shells and saying: "Remember these? He likes them. They helped win the battle of ....."

Because in some cases a factory is still making its peacetime product and workers may feel they are not contributing to the war effort, a display was recently built, for example, around the subject of ropes. One poster showed lifeboats being lowered over the edge of a torpedoed ship, with the caption: "Our ropes helped lower these sailors to safety." This gives new enthusiasm to any factory worker who may have felt his job unimportant and wondered why the firm he worked for didn't start making the more obvious tools of war.

Many factory workers never see the finished article for which they labor. Hence a placard that says: "They use our Kine-Theodolites on Hush-Hush gun-sites." It helps make a dull and routine bench job have its place in winning the war.

An unusually popular placard shows a British soldier, one trouser leg shot off, standing on the shore and holding aloft a trophy brought home from the Commando raid on Dieppe. This photograph was enlarged from a snapshot. It packed a lot of human interest and, being thoroughly unposed, rang the bell.

These wall displays, big and little, are also used to combat absenteeism, which, in a country that has fought a war for four hard years, can become a real problem. A typical placard reads: "This gun can shoot 250 rounds a minute. Last month ..... minutes were lost in this factory alone through absenteeism."

Many factories make a practice of letting each worker sign his or her name to the margin of these posters. That brings the message home. It is also a silent pledge on the worker's part to work even more earnestly toward the common goal. Sometimes these posters bearing workers' names are sent on to an army camp and the soldiers write personal letters of thanks. The lift to factory morale thus produced is considerable. There is also a boost to production whenever any returned war hero visits any factory and tells his story at first hand.

In some plants a bulletin-board newspaper, kept fresh week by week, makes timely use of newspaper clippings and even personal letters. The idea is to keep the story fresh and lively.

Occasionally pay envelope stuffers are used. These are of necessity small, because the paper shortage in England is a real thing. All paper, in fact, is watched closely. The stock used for wall posters and placards, for instance, is thin and is turned in for salvage after a couple of weeks. One batch of posters was even printed on the blank

Exhibit in van is designed to show non-ferrous metal workers the uses to which their products are put

reverse side of peacetime poster material found on hand.

Because the majority of Britain's factory workers are now women, many of them housewives with no previous business training, moving pictures are being used to clarify production jobs.

Women learn to do a simple factory job quickly and expertly, but usually do not have imagination enough to picture the complete workings of the factory where they work. So the Ministry of Supply in conjunction with British Paramount has produced a number of 11-min. reels, showing in brief detail how various essential items are manufactured. These factory shorts are shown during the meal break—meaning the lunch hour—and never cut into actual production time.

Over and above telling new war workers about the operation of their own plants, these factory shorts show how items used in everyday life have a new and special importance in war. Take electric lamp bulbs. A movie shows not only how they are made but also the extensive variety required for the machinery of war. New and specially made bulbs are required for headlights for armored trucks and tanks, made to withstand the tremendous vibration and shock. Blackout bulbs of many sizes and types are important; likewise flashlight bulbs. Signal lights, floodlights for landing fields, and enormous searchlights also are being produced, and these demand war priority. Any conscientious worker seeing this film, which is informative and not essentially a propaganda job, understands better why government officials counsel turning out electric bulbs at home when not in use.

Newsreel Service

A special newsreel, "Warwork News," ties many of these production stories together for comfortable showing in all war factories requesting this service, and also in local cinemas.

Although practically all war activities in Britain head up in or around London, an effort is made to do the publicity job nearer home and to give each industry the type of material best suited to its needs. Some ministries decentralize into 12 regional districts, each with its own convenient office.

One easily administered and palatable stimulant that has helped along wartime production is a daily program over BBC—the government-sponsored British Broadcasting Company—called "Music While You Work." This is piped in to all war factories.

With the influx of thousands and thousands of new and unskilled workers, plant safety committees have tremendously widened the scope of their work. Posters, often with a rhymed caption (Britons love their jingles), drive home the message of being careful. Workers are urged to avoid droping oil where someone might slip in it and get a nasty fall, to mark defective stepladders which might collapse.

Suggestion plans are a new departure for many British factories. Within a few months after Sir Oliver Lyttleton, Minister of Production, urged the installation of suggestion boxes in all war factories, one firm in

the Midlands section of England reported that 50 percent of the suggestions received were proving useful. Best results are gained by staging contests, the top suggestion in each three months' period being awarded a prize of £5—about $22 now. The top suggestion of the year receives a supplementary prize of £25—about $110 in American money.

The Ministry of Aircraft Production has worked a new series of production charts. Some are a simple blackboard idea, on which production charts have been broken down into figures per week for that department.

A more dramatic production chart is built like an enlarged ruler, on a plywood base. Two pointers move along the ruler. Each is marked with a colored lamp bulb. White light indicates the production needed to live up to the month's schedule. The colored light shows production achieved.

Labor and management in Britain, it may be said in conclusion, have learned much from this war. Just as officers and men of any fighting unit become fused into one when they go under fire, so management and workers of England's factories have developed a new unity of purpose because they have been bombed, have gone without hot meals and sleep, and have suffered the anguish of four years of war. Britons feel they have achieved something here that factory managers in America still can only dream of. Britain, for instance, has occasional strikes, but they are small and relatively minor. It cannot understand how John L. Lewis can call out half a million essential workers in a time of war and get away with it.

"Some people regard this factory publicity as merely a war measure," says a spokesman for Britain's Ministry of Supply. "We feel, however, that it is capable of permanent good. From the problems of war, demanding new products in great quantities, from unskilled hands and in widely scattered plants, we are learning much about the relation of labor and management. Both sides realize they have a new community of interests. We look for good results from this experience."

After the War

How long such measures can have effect depends, of course, on how naturally the publicity springs from spontaneous sources, instead of being selfish propaganda handed down from above. Probably, too, the tempo will have to be relaxed somewhat. One cannot apply the whip of war necessity through long years of peace.

British factories already are looking forward to peacetime production. Not that the war is ended, or the end even in sight. But, after four years, production of some war items can begin to taper off, and certain essential goods can now swing into production. Locomotives and rolling stock are to be made again, for instance, for use in occupying Europe; some may well be needed to replace badly overworked equipment inside the United Kingdom. Wartime regulations are not being relaxed, however. Britain's homes have long gone unpainted. Her clothing has been patched and patched again.

It is a fair question to ask to what extent British labor is beginning to itch for a hand in management. Britain has not yet seen any signs of labor climbing into the saddle too suddenly or too unpleasantly. The task of education goes on, showing labor that management, too, has a job. It is management's responsibility to maintain its right to do the bossing, to lend a willing ear to suggestions from labor, to reward suggestions, and to give workmen opportunities for promotion.

One type of British poster (above) leaves room for management to explain to employees how the work of their hands is helping on the battle front. Below, production scoreboard, British model. Posters, scoreboards, bulletin-board newspapers, music, all help to spur the worker to additional effort

Constant-Motion Line Speeds Assembly, Saves Space

CONSTANT-MOTION LINES for fabrication and assembly of wing panels at Bell Aircraft Corporation furnish operators with a steady flow of work, allow the utilization of unskilled help, and cut down the amount of floor space needed. Approximately 85 percent of the work on the wing lines is now performed by women.

All three advantages afforded by the installation of the constant-motion lines help speed up production of Army P-39 Airacobras. On the lines the work is timed to furnish each operator with a specific job to be done in a given amount of time.

The overall job of fabricating and assembling a wing panel is now broken down into hundreds of small jobs. In former years, when a small group of workers started and finished a panel, each of the group had to be fully acquainted with the thousands of individual operations necessary to complete a panel.

Simplified Operations

On the constant-motion lines, there are six workers at each station. Each has the same operations to perform on each panel that rolls through that station. It is estimated that the inexperienced woman worker can, in a short time, master her job so as to do her few operations 25 percent faster than the experienced worker performed the same operations under the old system, when he had hundreds of other jobs to perform on the one panel.

Floor space is conserved mainly through elimination of numerous and bulky parts racks. Prior to the use of the constant-motion lines, operators assembling and fabricating a single wing panel had to be surrounded by parts containers to remain busy at the job. To eliminate constant travel to and from parts cribs, they had to have the parts close at hand.

All parts of a given type are now stacked on a single rack at the particular station where that part is fabricated and assembled. Instead of each wing panel in process of assembly requiring rack space for gas-tank covers, fuel bags, landing gear, and all the other thousands of parts that go into a single panel, gas-tank covers are now kept on a single rack at the station where all gas-tank covers are assembled, fuel bags are kept together in another rack in the station where they are installed, and so on.

On constant-motion lines, the skeleton of the wing panel is first assembled in a supporting master fixture which passes through each of the many stations of a line as additional parts are added to that skeleton. Under the old method, many different fixtures were required to furnish workers access

A single master fixture is now used in fabrication and assembly of wing panels on Bell Aircraft's conveyorized line. Operators are assured a steady flow of work. Unskilled help can be used. And less floor space is needed. Net result is increased Airacobra production

A major reason for the substantial saving in floor space is that fewer parts racks are now needed. A single rack at each station holds only parts and materials that are to be assembled there

SORT AND PLACE PLYWOOD LINERS IN PROPER COMPARTMENTS - #1 TO #6
APPLY ZINC CHROMATE TO BACKS OF REAR LINERS - ALSO BULKHEAD LINERS IN #1 AND #6 COMPARTMENTS - (A)
SET LINER IN PLACE - (B)
COMPANY INSPECTOR CHECKS OPERATIONS -
14507

To instruct operators, thereby speeding fabrication and assembly, there is a portfolio at each station containing photographs and descriptions of every operation performed at that station

to all assembling areas of the panel. By eliminating the necessity for numerous fixtures, not only is floor space conserved, but the non-productive time formerly required in changing a panel from one fixture to another has also been eliminated.

On constant-motion fabrication and assembly lines, ultimate production is vitally dependent upon the timing of a number of major subassemblies, which makes it imperative that production supervision has at all times a complete picture of assembly progress.

A clear, simple picture of all operations in the wing panel assembly procedure is kept available for instant check in the office of John E. Rae, superintendent in charge of wing assembly. Through a color chart system the assembly of any major part of wing panels at any given time is readily known at a glance.

Penciled Squares

The color chart is drawn off on blank paper. Squares are penciled on the paper and numbered, each square representing a set of panels. The number of squares equals the number of panel sets requested in a work order.

Each square is first broken down into halves, for left and right panels. Both a left and a right are required to make a set of wings. Each of the halves is further broken down into thirds, and each half is colored in individually. The first two panels to go on the moving assembly lines represent the No. 1 square on the color chart, as left and right panels are placed on the line alternately.

Three colors are utilized in charting the progress of the individual panels. The left side of the top third of the No. 1 square is filled in with blue as the particular panel goes onto the moving lines. The blue reveals that subassemblies are ready and that panel is in the process of final assembly. Green is filled into the space immediately below when the panel leaves the moving lines. That color reveals at a glance that the particular panel has been completed and has gone through the paint shop. The last color to be added to the section is red, revealing that the particular panel has left the department.

If any wing lags behind, a white spot shows up in the chart and supervision can quickly check the cause of the hold-up. Supervision does not have to wait until the end of the month to determine just where production stands.

The six major subassemblies that go into a wing panel are front beam, rear beam, auxiliary beam, leading edge, trailing edge, and spindle bearing. The progress of the assembly of these parts is kept on individual sheets of a loose-leaf binder. They are also kept in rotation by number. For example, when the left front beam of No. 1 panel is assembled into a unit, the date the assembly is completed is marked next to the set number in the loose-leaf binder.

Quick Checking

Whenever a white spot shows in the color chart, supervision can check it against the subassembly sheets in the binder to determine exactly what subassembly is holding up completion of the particular panel. Supervision's problem at that point is to get that particular subassembly up to date so that completed panels may roll in order off the end of the line.

The color chart affords the assembly department a ready check on just what panels are ready for shipment at the moment a call comes from the fuselage assembly plant for wings. Supervision of the wing panel assembly does not have to run down into the shop to determine the number of panels ready for immediate or future shipment, nor does it have to check through stacks of paperwork to furnish an answer.

Guidebook Makes Workers Feel They "Belong"

ROBERT SALTONSTALL, Personnel Director, Arlington Mills, Lawrence, Mass.*

ONE OF THE MOST EFFECTIVE means by which a large organization can assimilate and adjust new employees to their surroundings is through a guidebook of information.

"Our Jobs Together" is the title of the Arlington Mills booklet which tells employees, particularly new employees, what they may expect from the company and what the company, in turn, expects of them.

The booklet is so set up that each pair of facing pages discusses one subject. The left-hand page describes company policies; the right-hand page tells what is expected of employee.

In addition to making employees "feel at home" the booklet provides:

1. *For management,* a clear-cut statement of labor policy which will guide supervision in dealing fairly and consistently with all employees. Management's control is thus improved because there is less leeway for individual interpretation of unwritten rules.

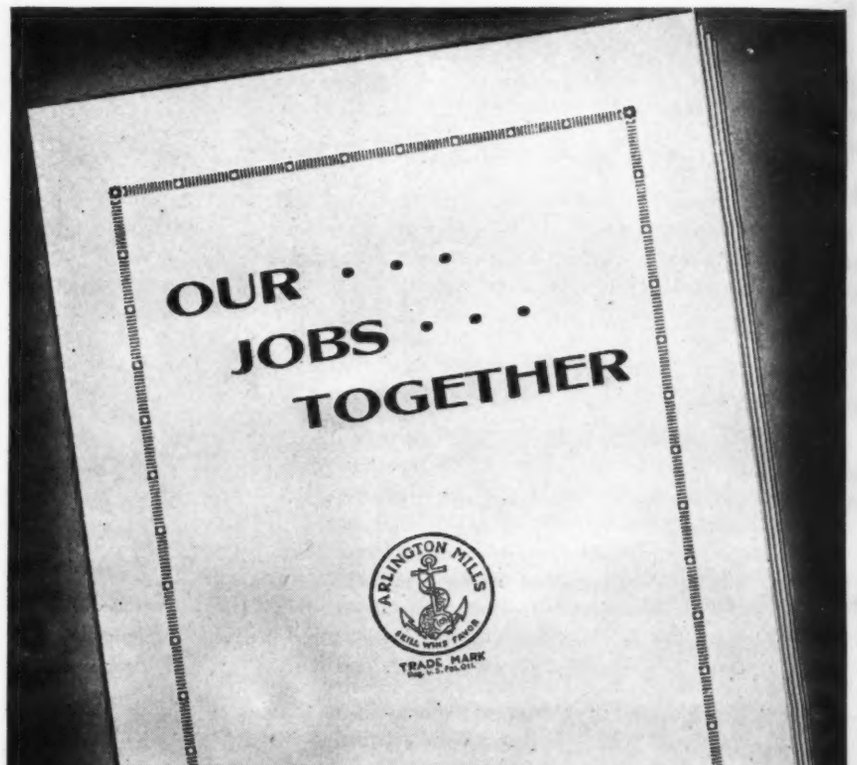
2. *For supervisors,* a clear statement of company policy which they are responsible for carrying out at all times. It also indicates what sort of conduct they have a right to expect from employees. Thus it guides them in dealing fairly with employees under normal circumstances.

3. *For old employees,* the realization that there are certain well-defined regulations which must be complied with for the benefit of all. Equally important, it provides a clear statement of the standards of treatment which employees have a right to expect from supervisors.

4. *For new employees,* a quick and effective introduction to the company, a clear statement of company labor policies, and a permanent guide to proper conduct on the job. It reduces unnecessary questions and prevents the misunderstandings which might lead to separation.

The entire booklet is designed to emphasize the "give and take" relationship of management and employee. The booklet begins with a friendly statement signed by the president, followed by a short "Story of the Arlington Mills" which awakens in the employee a sense of pride in being associated with a progressive, wide-awake, and capably managed organization.

Nine main subjects are then discussed on each of the following sets of facing pages. The left-hand page is headed "This is Arlington Mills job," under which the employee is told of



Guidebook of information for employees (actual size, 4x7 inches) prevents many of the misunderstandings that lead to separations

* Since writing this article, the author has enlisted in the Navy.—ED.

OPPORTUNITY FOR ADVANCEMENT

THIS IS ARLINGTON MILLS JOB

GENERAL POLICY:

The Mill will place you wherever possible in work for which you are best adapted and where you will be best satisfied. In judging employees for promotion, efficiency and experience will be considered first; where candidates possess these in equal measure the employee with greatest seniority will be promoted.

PROMOTIONS FROM WITHIN:

Vacancies arising from within the Mill will be filled by promoting present employees, wherever possible. Persons will be hired from outside, only when, in the opinion of management, no present employees qualify adequately for the job.

TRANSFER AND PROMOTION:

The Mill will encourage transfer of capable, experienced employees from one job to another so as to build up their skill, versatility and earning power so that they may qualify for future promotions.

REFUND OF SCHOOL EXPENSES:

Employees are encouraged to prepare themselves for promotion by taking advantage of educational opportunities. The Arlington Mills will refund the tuition of those employees who satisfactorily complete a course of study at Lowell Textile School or any other accredited course approved by the Mill.

LIBRARY:

Interesting and informative reading material are provided for your use in the Plant Library as well as through the monthly mill publication, Arlington Mills, *News and Views*.

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OPPORTUNITY FOR ADVANCEMENT

THIS IS YOUR JOB

PREPARE YOURSELF FOR PROMOTION:

Equip yourself for future advancement by acquiring a thorough knowledge of your present job, by having an efficient operating record, by cooperation with your supervisors and team work with your fellow employees.

CONDUCT:

Demonstrate on the job those qualities of behavior, good sense, skill and judgment which you must possess in order to qualify for a better job.

LEARN ABOUT OTHER JOBS:

Learn ahead of time as much as you can about the other jobs in your department so that you will be ready and qualified for promotion when your chance comes.

HOW TO APPLY FOR TRANSFER OR PROMOTION:

Consult your Overseer or the Employment Manager when you wish to be considered for transfer or promotion, and your request, along with others, will be taken up when an opening occurs for which you qualify.

OUTSIDE STUDY:

Develop your knowledge, ability and experience through outside study and education. The Employment Office will supply you with information as to the various courses that are available for you to take.

LIBRARY:

Make use of the magazines and books relating to textiles and other subjects which you may borrow on request from the Library located at the Employment Office.

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One subject to each pair of pages. Left, company policy. Right, worker's responsibilities

his rights and privileges and is given other information answering the questions most likely to arise in his mind. The right-hand page is headed "This is your job." This page contains a straightforward statement of the employee's obligations to the company.

The nine headings are: Employment; Wages and Job Performance; Working Conditions; Hours of Work; Regularity of Employment; Opportunity for Advancement; Safety and Health; Group Relations; Conduct.

Every effort has been made to arrange these subjects logically in the order of their relative importance so that the new employee will be gradually drawn to read through the book as each new question comes to his mind after he starts work. The question of conduct is significantly placed last so that the new employee will not immediately gain the impression that if he makes a mistake he will be subject to discharge. Most of the subjects covered under "conduct" have been taken up with less emphasis on the previous pages, however, so that there will be no occasion for the employee to state that he did not know the rules.

"Our Jobs Together" is the employee's individual property and is of such a size (4x7 inches) that he can keep it at home or in his locker or, if he wishes, carry it with him for reference.

Guidebooks for new employees have value only if they are read and used consistently. To keep up interest in the guidebook, the company plans a series of questionnaires in the monthly mill publication. "Arlington Mills News and Views," which will challenge employees to find the answers by referring to their individual copies of "Our Jobs Together."

Many high officials have emphasized that the interests of employers and employees are essentially the same. "Our Jobs Together" tries to show the employee not that his interests are absolutely the same as those of management but that both management and employees have their rights and privileges which they are mutually bound to respect at all times.

This "give and take" relationship, with respect for the other party and with fair treatment by both sides, should help to build the morale and cooperation that must exist for efficient manufacturing operations during this war emergency.

Process Charts Point Way to Man-hour Saving

G. A. HORNBERGER, Supervisor of Methods and Standards, Diamond Crystal Salt Division of General Foods Corporation, St. Clair, Mich.

OLD METHOD — Dating and Filling 100-lb. Paper Bags

DIST. (ft.)	TIME (min.)	PROCESS DESCRIPTION
	2.00	[1] Packing foreman read schedule
	2.98	(1) Write order for bags
100	.50	Carry order to elevator
	.04	(2) Elevator operator pick up order
75	1.28	Take order 1st to 5th floor
	.25	(3) Give order to storeroom foreman
	.62	[2] Foreman read order
	.74	(4) Adjust stock card
	.40	(5) Give order to clerk
	1.24	[3] Clerk read order
50	.50	Walk to elevator
	.10	(6) Ring for elevator
	1.70	Wait for elevator
90	3.20	Ride 5th to basement
30	.30	Walk to four-wheel truck
330	2.57	Push truck to bag storage
	4.18	(7) Load 1000 bags on truck
300	2.88	Push load to elevator
	.10	(8) Ring for elevator
	1.70	Wait
20	.34	Push load on elevator
90	3.20	Ride to 5th floor
40	.75	Push load to bench
30	.15	To dater storage
	.32	(9) Get dater and ink
30	.15	Back to bench
	.35	(10) Ink dater
	.08	(11) Cut rope from 100 bags
	.28	(12) Remove cover from 100
	.11	(13) Aside rope and cover to bench
	.97	(14) Position 100 bags on bench, 25 at a time
	1.03	(15) Date 100 bags, 25 at a time
	.33	(16) Aside 100 dated bags to flat, 25 at a time
		After dating 1000
40	.75	Push flat of dated bags to elevator
	.05	(17) Ring
	.85	Wait
20	.34	Push load on elevator
75	1.28	Ride 5th to 1st floor
60	1.13	Push bags to storage in packing room
60	.30	Walk to elevator
75	1.28	Ride 1st to 5th floor
40	.20	Walk to bench
	1.24	(18) Pile waste paper from bench to flat
40	.75	Pull flat to elevator
	.05	(19) Ring
	.85	Wait
20	.34	Push flat on elevator
75	1.28	Ride 5th to 1st floor
40	.75	Push flat off elevator
	.14	(20) Warehouse truck driver pick up load of waste paper
530	4.96	Truck to storage on dock
35	.33	To other work
40	.20	Walk to elevator
75	1.28	Ride 1st to 5th floor
40	.20	Walk to bench
	.60	(21) Aside rope to waste crate
40	.34	Push crate to elevator
	.05	(22) Ring
	.85	Wait
20	.17	Push crate on elevator
45	.96	Ride 5th to 2nd floor
175	2.05	Push crate to rope storage
	1.50	(23) Dump crate
175	1.99	Push crate to elevator
	.05	(24) Ring
	.85	Wait
20	.12	Push crate on elevator
45	.96	Ride 2nd to 5th floor
40	.24	Push crate to storage
	.25	(25) Packing room operator pick up 100 dated bags
35	.71	Carry bags to machine
	.15	(26) Position bags at machine
	.09	(27) Put bag on machine
	.01	[4] Watch machine fill bag with salt
	.06	(28) Remove bag from machine and tuck in valve
	.02	(29) Drop bag on conveyor

SUMMARY — OLD METH

Operations	29
Inspections	4
Transportations	37
Storages	6
Distance in feet	3045
Time in minutes	65.91

ONE OFTEN-HEARD REMARK, "But it's always been done this way," is a common hurdle in any work simplification program. An operator can perform unnecessary tasks day after day, and never realize that all the effort and energy he is expending mean nothing in the finished product. A process chart, which shows graphically how much of his effort he is wasting, will generally convince him.

Here at Diamond Salt, to cite a single example that comes readily to mind, we had always dated cotton bags by hand, and because the storeroom had been dating and delivering the cotton bags, it was assumed that the job of dating paper bags would follow the same procedure. A process chart illustrates the method formerly in use (opposite page).

It was obvious that the job could be improved, so we asked the customary why, where, how, who, and when questions:

1. Why were the bags elevated from the basement to the fifth floor and brought back down to the first, just to have the bundles opened and the bags dated? They should not be elevated and brought back.

2. Where should these jobs be done? In the packing room, where the bags are filled.

3. How should the dating be done? By an automatic dater on the filling machine.

4. Who should do it? Not the storeroom, but the materials warehouse department, because that is where the bags are stored.

5. When does it have to be done? Before noon the day after the order is received.

It will be noted on examination of the process chart that more than one department was involved, and that the operations performed by men from these departments have been charted, one after the other, to show the complete job. Also, the job is highly repetitive, one that requires considerable labor, and one that will be in effect indefinitely—a job, in a word, that lends itself to a detailed study to find the "one best way" to do it.

The next step, then, was to find out how many bags are used, and to calculate the time and money that could be saved. Clearing with the superintendent and the foremen of the departments concerned took care of the changes from one department to another.

Next came the problem of the automatic dater that was to be installed on the filling machine. This job was turned over to the research and engineering departments. After some experimenting, the proper place to date the bag was discovered. A draftsman designed a self-inking dating machine. It was made up by the machinists in our shop. The first attempt was unsatisfactory—the dater was cumbersome and not too positive. But one of the machinists who had worked on it came through with an idea for a better one, and was told to go ahead and make it. He did, and his dater has proved eminently successful.

A new process chart was made (see below), showing how much simpler, how much easier, and how much more economical the proposed method would be. This information was presented to management, and the authorization to make the change was readily given. Incidentally, the change-over was made without a single serious hitch.

There are many reasons, in our experience, why unnecessary operations are performed. The "how to do it" instructions are passed along from one operator to the next, verbally. The further they are passed on, the more they accumulate. But there is one sure cure—a cure that, in our plant, at least, works every time. Its name is "work simplification."

NEW METHOD — Dating and Filling 100-lb. Paper Bags

DIST. (ft.)	TIME (min.)	PROCESS DESCRIPTION
	2.00	[1] Packing foreman read schedule
	2.98	(1) Write order for bags
150	.75	○ Order delivered to warehouse supervisor
	.62	[2] Read order
	.74	(2) Adjust stock card
	.40	(3) Give order to warehouse man
	.62	[3] Read order
35	.18	○ To bag storage
	.33	(4) Position flat
	.08	(5) Cut rope from 100 bags
	.28	(6) Remove cover from 100
	.09	(7) Aside cover to flat
	.02	(8) Aside rope to pile
	.27	(9) Pile 100 loose bags on flat
		After piling 1000
	.14	(10) Flat of bags picked up by warehouse truck driver
90	.84	○ Truck to elevator
	.05	(11) Ring
	.85	▽ Wait
20	.19	○ Drive on elevator
15	.32	○ Ride basement to 1st floor
195	1.82	○ Truck load to packing room storage
35	.33	○ Drive to other work
	.14	(12) Pick up load of waste paper
530	4.96	○ Truck to storage on dock
35	.33	○ To other work
	.43	(13) Janitor picks up waste rope
110	.66	○ Wheel to storage
	.27	(14) Aside rope
30	.15	○ To other work
	.25	(15) Packing room operator pick up 100 bags
	.71	(16) Carry to machine
	.15	(17) Position at machine
	.09	(18) Put bag on machine
	.01	[4] Watch machine fill bag with salt and date bag
	.16	(19) Remove bag from machine and tuck in valve
	.02	(20) Drop bag on conveyor

NEW METHOD	SAVING
20	9
4	0
11	26
1	5
1245	1800
22.13	43.78

Supervisory Problems—No. 6

WHAT WOULD YOU DO IN A CASE LIKE THIS?

Sixth in a series of articles on methods used at Carnegie-Illinois Steel Corporation, Pittsburgh, to stimulate discussion in foreman training classes. Developed by R. J. Greenly and E. B. Mapel, Industrial Relations Division

An open hearth department foreman recently promoted one of his pit cleaners. The foreman was familiar with the SWOC contract clause which provides that in promotion "... where the factors 'ability to perform the work,' and 'physical fitness' are relatively equal, length of continuous service shall govern," yet he unintentionally "passed up" a man with 26 months' service in order to promote another man with only 18 months' service. This resulted in a grievance which was settled easily in the first step because another opening permitted a similar promotion for the older man. The older man, however, continued to resent the foreman's original action even though the adjustment was made.

A short time later another promotion took place. This time again the foreman promoted a man with less service who was exceptionally well qualified, while three men were "passed up" without warning or explanation. This time a grievance was raised which was settled in the third step when it was demonstrated that the foreman's action was correct and justifiable.

Last week a similar situation arose which led the foreman to make a promotion in which other factors, in his opinion, were more important than length of service. This time a grievance was taken directly to the management of the plant, requesting that severe disciplinary action be taken against this foreman. The union maintained that the foreman consistently had violated the contract by ignoring the seniority clause.

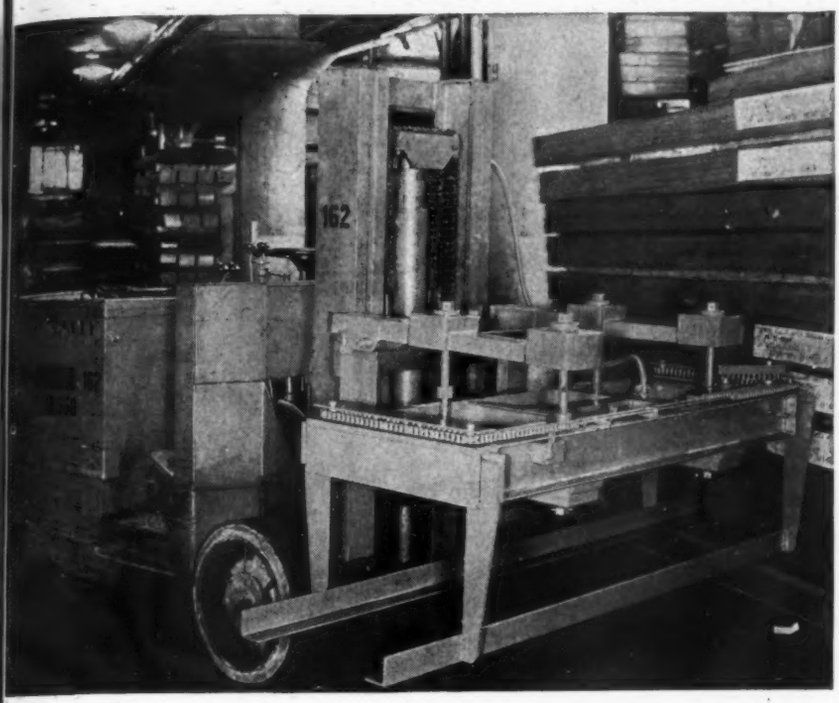
While investigating the case it was discovered that the foreman had made 26 promotions during the past four years. Twenty of the promotions were in accordance with length of service, and five were based on other considerations. These five cases had the approval of the union. In one case (see first paragraph above) the foreman admitted an oversight and made correction within a few days.

The following statements apply to this situation. Study each one carefully. If you agree, put a circle around the "T" following the statement. If you do NOT agree, circle the "F". If you are in doubt, circle the "??".

1.	This foreman has consistently violated the spirit and intent of the SWOC contract.	T	?	?	F
2.	A foreman can make his job easier in the long run by considering only length of service when deciding upon promotion.	T	?	?	F
3.	A foreman is committing a serious error when he passes up a better qualified man to make a promotion on the basis of seniority alone.	T	?	?	F
4.	It usually reduces productive efficiency to promote on the basis of seniority alone.	T	?	?	F
5.	When a foreman plans to promote a man "around" another who has greater seniority, he should talk it over with both parties so that the reasons are understood.	T	?	?	F
6.	It is the intention of the SWOC contract that all promotions which do not follow the seniority principle should be explained and justified before they go into effect.	T	?	?	F
7.	A foreman should review the record of each man at least once a year to be certain that no one is overlooked in regard to promotion.	T	?	?	F
8.	Most foremen have adequate records to support their opinion regarding the qualifications of their men.	T	?	?	F
9.	It often happens that a foreman is certain that one of his men is better than another, yet he cannot prove what he knows to be true.	T	?	?	F
10.	A foreman can make decisions regarding promotion much more easily and accurately if he keeps a continuous record of all his men, showing unusually high or low production, incidents of special cooperativeness or lack of cooperativeness, rule violations, merit ratings, special education or training, and similar data.	T	?	?	F
11.	This foreman, although his decisions were fair and just, gave the appearance of being unfair because he failed to explain his decisions to his men.	T	?	?	F
12.	This foreman should have reviewed his promotions with his grievance man periodically in order to make certain that the decisions were understood and accepted.	T	?	?	F
13.	The foreman should have promoted an unqualified man in order to avoid an argument over seniority.	T	?	?	F
14.	The company often is unable to stand back of a foreman who tries to promote his men on the basis of merit because the foreman has no record to prove that his decision is fair.	T	?	?	F
15.	A departmental committee should be established to pass on all promotions, in order to relieve the foreman of that responsibility.	T	?	?	F
16.	The SWOC should help select workers who merit promotion.	T	?	?	F
17.	Records relating to qualification for promotion should be maintained by the personnel office rather than by the foreman.	T	?	?	F

MANAGEMENT SHORTS

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary management accomplishments. Accepted articles will be paid for



Power-operated sheet steel grapple mounted upon an inverted fork arrangement on a conventional battery-powered truck speeds materials handling and permits utilization of once inaccessible areas

This Method Speeds Materials Storing

JOHN L. LARE, General Electric Company, Fort Wayne, Ind.

In one department storage and handling facilities for lamination sheet steel were overburdened. The only available space that could possibly accommodate the floor load was the basement.

This steel is received for storage in packages consisting of three or four 5000-lb. lifts, separated by lengthwise dunnage strips. Before being stored the banding is removed. Subsequently the steel is handled in 5000-lb. units. The steel varies from 26 to 32 inches in width and is up to 122 inches in length. Its gage is too light to permit safe movement by forks in an unbound bundle, and previously an overhead crane had to be used to handle the stock.

A power-operated sheet steel grapple mounted on an inverted fork arrangement on a conventional battery-powered truck is now used for the entire operation of handling and storing this steel. This method makes possible the storing of approximately one-third more stock in the available area than could have been done with overhead cranes. Also, the grapple is easily attached and removed, and standard forks can be substituted on the truck. Such flexibility permits almost unlimited handling of the stock in any area in the plant.

•

From "Pep-Up Stand" in plant, Scott Paper Company, Chester, Pa., dispenses free soft drinks—part of its "Backing America—Every Day" program.

•

Special Order Card for Special Orders

E. P. DOLLIVER, Production Manager, R. Wallace & Sons Manufacturing Company, Wallingford, Conn.

Jobs that are standard in neither batch size nor sequence of operations always seem to get buried somewhere. They can be effectively handled, however, with a "special order route card." The processing departments through which the order must go are checked in the space provided at the

HOLLOW HANDLE CUTLERY

SPECIAL ORDER ROUTE CARD

DATE _____

DESCRIPTION _____

QUAN. _____ DOZ. ____ STAMP _____

H. H. CUTLERY

WHEN WANTED _____ PROMISE TO SHIP _____

STAMP RECEIVED _____

This card MUST be filled out with dates and Foreman's initials when RECEIVED and when FINISHED in each Department.

Process		RECEIVED		FINISHED	
		Date	Foreman	Date	Foreman
	Stamping				
	H. H. Anneal				
	Buff				
	Gilding Room				
	Packing Room				

INSTRUCTIONS: Return This Card When Order Is Packed.

left of the form. As the work is received in each department, the foreman or his assistant must indicate the date and initial the card. When the work leaves their department, they must add date and initials again. The adoption of this system will cut down order-chasing and speed delivery of the finished work.

•

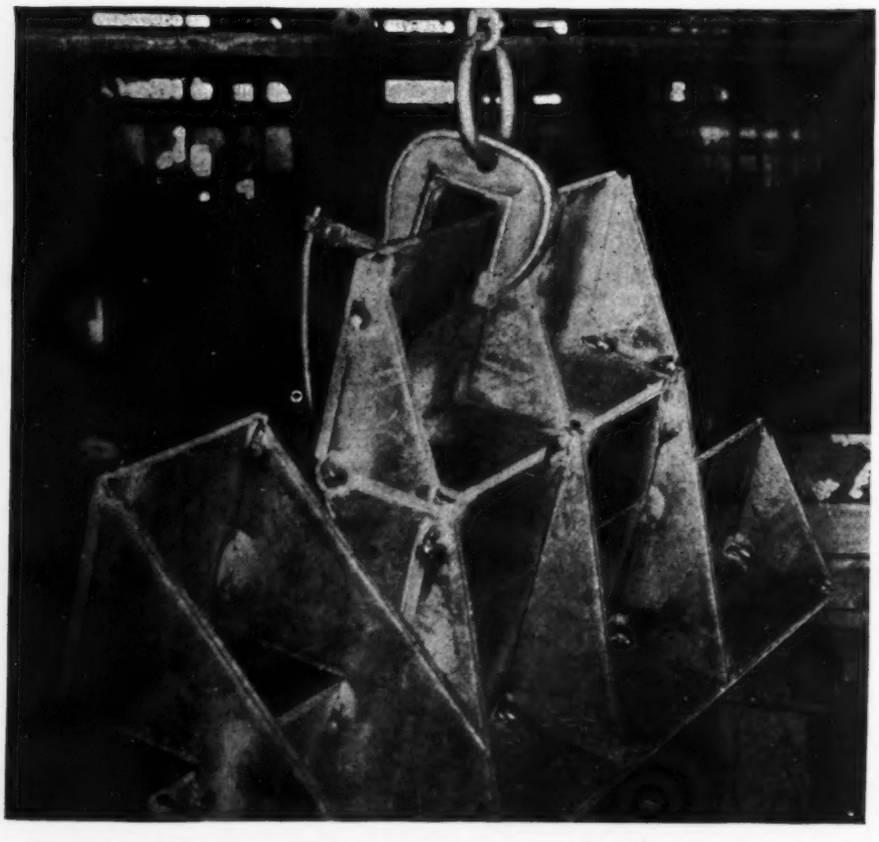
Prize Winning Safety Invention

Paul "Rocky" Caruso, a production line worker, in addition to being rewarded for his safety invention by Walter Kidde & Company, has been given a National Safety Council prize and designated as America's first industrial "Safety Ace."

He is employed on a testing operation in which the safety disks for raft inflation cylinders are exploded in order to determine the maximum pressures they can withstand. These disks burst with a nerve-shattering report and a dangerous spatter of flying metal particles.

Caruso invented a sort of muffler which fits over the exploding apparatus. It has resulted in a complete elimination of eye injuries from flying metal, and has reduced the noise by more than 75 percent, with a consequent reduction in work stoppages from this cause. Other employees came to know the intervals at which the explosions occurred and would stop work to brace themselves for the report of the bursting apparatus.

Paul "Rocky" Caruso is shown with his prize-winning safety device, which fits over the mechanism for testing the maximum withstanding pressure of safety disks. It has entirely eliminated eye injuries



Heavy-duty C-clamp provided with a link for attachment to a chain does a good job in holding such heavy and unwieldly parts as this at the Harnischfeger Corporation, Milwaukee

Reduces Rejects by Shrinkage Fit

SOURCE—Westinghouse Electric & Manufacturing Company, East Pittsburgh

To reduce rejects in the press fitting of aluminum and steel parts, infra-red heating is now used at our small motor plant at Lima, Ohio. Until this method was set up, the mechanical operation of obtaining proper fits between hard and soft metal parts had always been more or less unsatisfactory. Aluminum motor frames are heated to 150 deg. C. This expands the 6¾-in. bore 0.020 inch, enough to allow the wound primary to drop in place.

When press fits are reduced to the point where scoring or galling does not result, the hazard of loose-fitting parts is greatly increased. Heavy scrap losses invariably result. Through the use of the infra-red heating method the shrink fit allowance is much larger than that practical for a press fit. A rotary conveyor, traveling at the rate of 30 ft. per min., carries the aluminum motor frames through a tunnel of 56, 375-watt lamps.

•

The meaning of " 'V' Depends On Me!"—slogan of Leeds & Northrup Company, Philadelphia—registers for each employee as he sees the reflection of his own face in a mirror above it. Mirror posters appear throughout the plant.

MAINTENANCE SERVICES

The well-maintained plant is the high-production plant

SELECTION • INSTALLATION • INSPECTION • UPKEEP • ORGANIZATION

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CHANGE OF ADDRESS

McGRAW-HILL PUBLISHING COMPANY
330 West 42nd Street, New York, N. Y.

Director of Circulation:
Change my address on Factory Management and Maintenance

From .....

.....

To .....

.....

Signed .....

FACTORY MANAGEMENT AND MAINTENANCE
McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

MAINTENANCE as the Editors See It

Start Now to Conserve Fuel Next Winter

A FEW TRUCKLOADS of insulation raised the wintertime temperature of a large plant building from Maine to Florida, as the plant engineer put it. An exaggeration, of course, but the fact still remains that this plant faced and solved a troublesome, costly situation.

Demand for more floor space forced a large department having a high percentage of women workers into a building formerly used as a warehouse. A new heating system that should have been adequate could not keep the place warm. The women were cold and unhappy, worked listlessly, stayed home on the slightest pretext.

Plainly too much heat was escaping through the roof.

A good layer of insulation underneath the roof deck stopped that waste with a saving in steam, which was worth much at a time when fuel was hard to get.

Workers must be kept comfortable, but the fuel situation requires that every effort be made to go easy on the oil tanks or coal pile.

One plant that formerly burned waste wood and paper in an outdoor incinerator hooked up the heating system to an old boiler in which the waste is now burned. This took a sizable load off oil-fired boilers.

Another plant has found that it pays to keep one man busy checking thermostats and room temperatures, seeing that the heating equipment is kept clean, and eliminating waste of heat in every way possible.

Cold weather is not so far away as it seems to be. Certainly now is not too early to start putting the heating system in good order and planning any changes that will save precious oil and coal.

Aptitude Tests for Maintenance Mechanics?

AND WHY NOT?. Such tests are widely used in selecting factory personnel for all manner of jobs, and are daily proving their worth. One well-known company in fact has recently adopted the practice of requiring all apprentices for the maintenance force to take some tests designed to show where these young fellows can best fit in.

Aptitude tests that are properly worked out and interpreted can do much to prevent the tragic waste of manpower and the destruction of happiness that come when square pegs try to fit themselves into round holes. Those who are unfortunate enough to get into a kind of work for which they have no liking are apt to make an indifferent success, if not an absolute failure, of it, and be unhappy and dissatisfied.

On the other hand, young fellows just going into industry seldom know where their chief abilities lie. They do not know the kind of jobs they can do best, nor those they ought to leave alone.

It is the purpose of aptitude tests to uncover some of these things, at least in part, and prevent the youngster from spending precious time in trying to master something for which he has no real liking or ability.

Details of the maintenance apprentice tests mentioned previously cannot be given here. They are designed, however, to show whether an apprentice should be put in the machine shop, or whether he is likely to do his best work as an electrician, carpenter, or steamfitter.

Those who have devised and are using these tests would not claim that they are infallible. However, they do constitute a laudable effort to solve a problem that is worth serious attention.

How Are You Meeting the Shortage of Maintenance Manpower?

HIGH-SCHOOL BOYS will spend their Saturdays washing the lighting fixtures in an eastern plant. All husky juniors and seniors, they do an excellent job with little supervision.

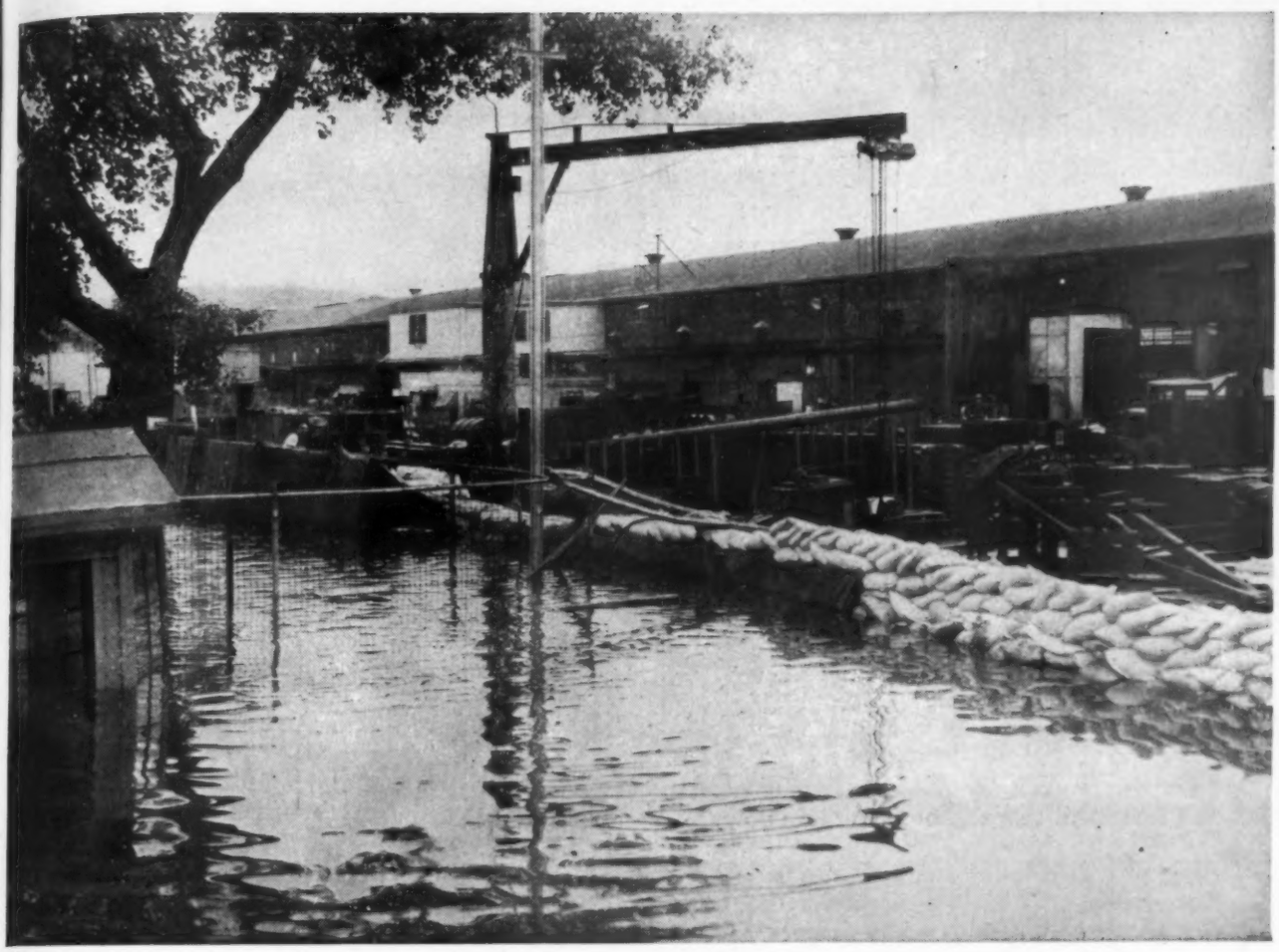
Women are doing the same work in another plant, but they are not required, or permitted, to use ladders. A member of the maintenance force removes and replaces all lamps and reflectors.

The shortage of suitable manpower is being felt sharply by many maintenance departments. The two instances cited are examples of successful efforts to tap relatively new sources of manpower, so far as the maintenance department is concerned.

How to make more effective use of the men available is, of course, a solution that deserves the most careful attention. One maintenance chief with a passion for system and paperwork was horrified to learn that the elaborate routine built up over the years was, under today's conditions, slowing down rather than expediting the work. It involved too much checking, too many reports, too much waste motion all around. Drastic streamlining of procedures has corrected that condition, and to this extent released an appreciable amount of manpower.

On the other hand, another maintenance executive found that the way to more effective use of his men lay in better planning, closer supervision, a more effective system of following jobs through to completion.

The editors would like to know how other maintenance chiefs are attacking their manpower problem.



It cost nearly half a million dollars to keep the Illinois River out of this plant last spring. But if the flood had got inside, the cost would have been $2,500,000 and weeks of production time

How We Beat the Flood

ELMER E. ISGREN, Plant Manager, R. G. LeTourneau, Inc., Peoria, Ill.

LAST SPRING we fought for three weeks to keep our plant from being flooded. That three weeks' battle required placing a full mile of tarpaulins. Nearly 8000 tons of sand was shoveled into 275,000 sacks. Forty cubic yards of cinders were dumped. Forty-five pumps were operated. Two hundred and seventy-five pairs of rubber boots along with large quantities of many miscellaneous items were needed. But, most important of all, was the iron determination and extremely high morale among nearly 3000 employees.

Water was nearly 8 feet high against the outside walls of the river end of the sandbagged factory, but it could not get to the vital machinery.

Altogether it cost us nearly half a million dollars to keep from being flooded. But, if the flood had won, production losses, based on 1942 sales figures, could easily have reached $2,500,000, plus reclamation costs. Stoppage of important war work was held to less than a week—a vital matter these days.

Plant No. 1 has no levees, although it is built out into the Illinois River on a dirt fill. Hence flood control had to start from the ground.

When placing sandbags a one-to-three ratio was maintained; that is, for every foot of height there were 3 feet of width. Two sandbagging techniques were soon evolved. The flood controllers found that up to 4 feet, it was wise to place bags of sand loosely, so that free sand could be shoveled between the sacks. No loose sand was employed above the 4-ft. water line, since mounting pressures created seep leaks. Tightly packed sandbags, pumps, cinders, and canvas combined to stop Ol' Man River when he climbed above 4 feet up the outside plant walls.

Some 15,500,000 pounds of sand, all in trucks except four trainloads, was used. Cinders, which absorb moisture and sink very slowly, were sprinkled along the tops of the sandbag walls. As they dropped gently into the water, they were sucked into seep holes, which were thus blocked.

Tarpaulins had double value. They kept out water and protected the buildings from excessive pressures, particularly when heavy winds arose. Various practical interweaving meth-

When waves, backed by a strong wind, rose as high as 2 feet, a breakwater of power line poles was devised. Poles were joined end to end, anchored to light standards, shifted as the wind changed

Canvas suspended from quickly built wood scaffolding helped to keep the waves from breaking piled sandbags and washing the sand away

ods were used to entwine canvas between the sandbag layers to shut out the water. To protect the buildings, tarpaulins were suspended from quickly built wood scaffolds that held the canvas at least a foot away from the structures. Thus the canvas stopped waves and watercaps before they could crack against the walls.

In some instances canvas was similarly placed ahead of sandbagging, to keep waves from breaking the bags and washing the sand away.

Perhaps the most ingenious arrangement set up to break waves was a floating breakwater of power line poles. When threatening waves shipped 2 feet high on an exceedingly windy day, and sandbags were seriously threatened, our flood controllers rented 30 power line poles, each 30 feet in length, from a local utility.

The poles were temporarily wired into rafts for towing, and were pulled by an outboard-powered rowboat to the place where they were to be used. Here they were re-wired end to end against a length of $\frac{3}{8}$-in. steel cable, 3000 feet long. Each end of the cable was then anchored to permanent steel light standards on the company yard fence, which was hidden in 10 to 15 feet of water. The steel light standards remained a few feet out of water, however, making the river level anchorage possible.

The plant we were protecting is

Like the mail, telephone service must go on. Board and operator were elevated out of harm's way

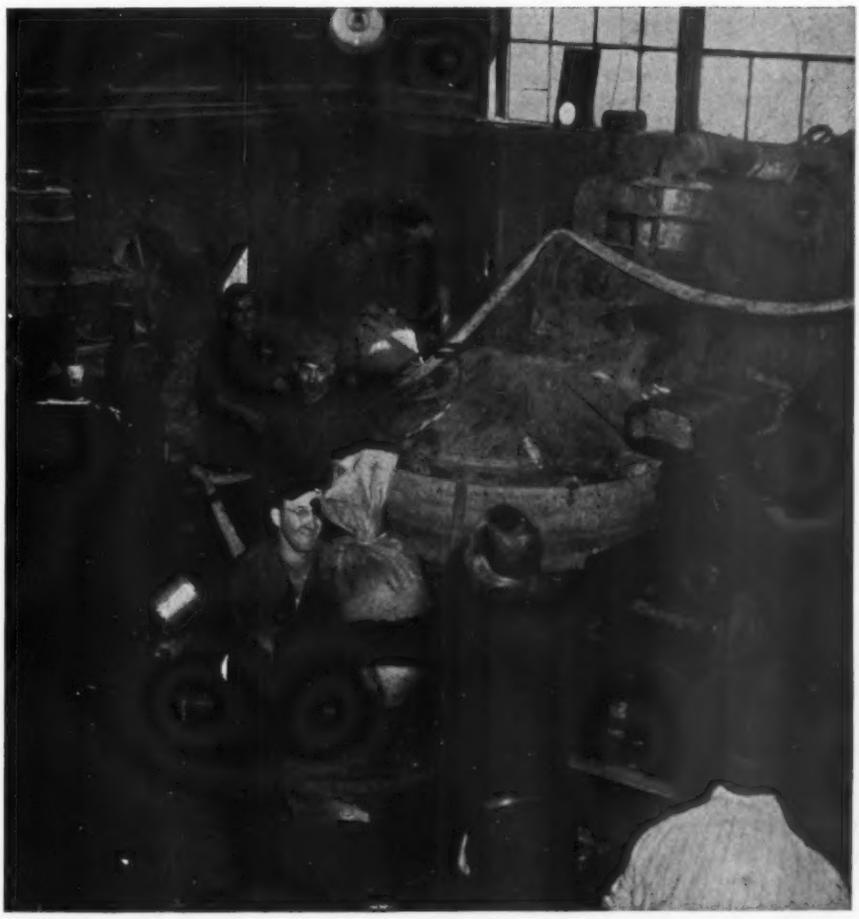
First aid station comes to the men. Nurses with first aid kits patrolled the flood lines 24 hours a day

on the west side of the Illinois River. When the wind was from the south east, the breakwater was strung along the east and south ends of the fencing. When the wind changed to the northeast, one end of the breakwater was loosened, pulled around, and reanchored to protect the north east corner of the jeopardized property.

Peoria Area U. S. Engineers inspected and approved the floating breakwater idea, and suggested that it would be practicable wherever river breakwaters are occasionally needed. Although the warning did not apply to our conditions, the engineers pointed out that navigation lights and continuous human patrol would be necessary if the floating breakwater were in or near the channel. It would be the duty of the patrol to see that the breakwater did not tear loose and smash into shore installations or river traffic.

At first bales of hay or straw were sought for a similar floating breakwater arrangement, but none was available. Such bales would become water logged and sink unless they were anchored on the surface. If they were anchor-controlled, however, they would halt even river swells, if necessary.

At one time there were 988 welders, fabricators, finishers, shippers, and other shop men working on the sandbag levees. Meanwhile, executives and other men and women office workers



Seepage! Right away sandbags were rushed to the danger spots by the flood controllers, who were always on the watch for possible breaks

Maintaining morale was no unimportant part of fighting the flood. A short-wave field transmitter brought right into the flood area allowed workers to let their families know that they were safe

were expediting flood-fighting materials. Generally speaking, the area from which such supplies were sought was bounded by St. Louis, Kansas City, Minneapolis, Chicago, Milwaukee, and Indianapolis.

The purchasing department got supplies at once, despite the critical status of many materials in these war days. Buyers telephoned and telegraphed their orders, made sure that truck drivers were ordered not to waste a second. Deliveries were further expedited by having the traffic department urge local offices of the transit companies to help keep the goods rolling.

Sand was hauled 24 hours daily from pits within 20 miles of Peoria. Our shop supervisors frequently spelled the tired truck drivers. Pumps were borrowed and trucked in from the Chicago quarters of the Illinois Defense Council. The district U. S. Coast Guard, based less than 1000 yards downstream at the U. S. Engineers offices, furnished more pumps and uniformed seamen-mechanics. When more tarpaulin was necessary, the U. S. Engineers rushed considerable amounts of canvas from Decatur and Granite City, Illinois.

Local ration boards stayed open day and night to approve purchase orders for rubber boots.

When non-routine supplies were needed, the members of our purchasing department quickly found manufacturers' addresses by consulting trade directories, local dealers, and the armed services. The purchasing, central stores, and traffic departments of Caterpillar Tractor Company, Keystone Steel & Wire Company, and other industries in flood-stricken Greater Peoria gladly exchanged expediting news and shared rush orders with Le Tourneau. Several smaller communities in central Illinois offered and delivered sandbags. Volunteered supplies came from as far away as the American Red Cross chapter at Clinton, Ind.

A Special Account

The cost accounting department set up a special flood control account. Some $80,000 shown on the account is still unspent. It has merely been earmarked so far for possible repairs to the river end of the Plant No. 1 main building. Exact repair needs cannot be determined until sufficient time has elapsed for any possible shifting or sinking of the land on which the structure stands. Some reinforcing may be necessary, and the walls, which stood under such heavy water pressures, will have to be thoroughly examined while production continues.

An important item not directly shown in the flood control account is that of labor, which was paid through the routine pay system. Le Tourneau executives worked in close harmony, side by side, with the heads and members of Local No. 158, AFL Boilermakers' Union, collective bargaining agent for our Peoria factories.

After the flood crest of more than 28 feet was recorded, several hundred production workers who had turned flood fighters were no longer needed. While some stayed to patrol, many others kept from enforced, payless idleness by taking their vacations. Thus manufacture is now speeding along on a generally vacationless basis to catch up with production time lost during the flood.

The advertising and public relations department helped materially in the flood fight by directing morale-building news and photo coverage. Reporters and photographers of the local newspapers and from United, International, and Associated Press were conducted on flood-line tours. Local newspaper reporters soon came to rely on having plant flood news telephoned to them at scheduled intervals as often as four times daily.

Radio Station WMBD at Peoria was similarly granted every possible courtesy. Its engineers and announcers brought a short-wave field transmitter into the plant area on a Sunday, when

the crest fight was nip and tuck. "We're safe, and we're winning," said sandbaggers into the microphone. Happy to have had the chance to tell their folks at home about their big battle, the workmen went back to flood fighting with vastly renewed spirits. Accurate news stories and photographs gave them the same lift.

As often as safety permitted, company and city officials, safety directors and nurses, cafeteria employees, and many others toured the flood areas to cheer the workmen. Our cafeteria cash register failed to ring for a week as $1905.66 in free sandwiches, coffee, and other edibles went to workers. Since it was advisable to leave a few inches of water inside buildings in some places, to offset outside pressures, cafeteria girls who did not own slacks, sloshed through shallow water in hip boots, which were partly covered by their dresses.

Typically cheerful nurses moved their first aid station supplies to the drier confines of the personnel department, packed homemade first-aid kits, and set up 24-hour patrol along the flood lines. Fortunately, there were no lost-time accidents. The nurses did treat 37 cases of sunburn during one day when the sun was bright. They also treated foot burns and counseled workmen against wearing rubber boots too long.

All departments made constant use of the plant's public address system and telephone switchboard. Both units were on 24-hour service. When rising waters threatened the switchboard, telephone repairmen elevated board and operator 2 feet higher on a platform scaffold. They remained to service the board, installing overhead lines when the last of the sixteen regular trunks was flooded out just as the crest was reached.

Tarpaulins had a double value. They kept the flood out of the buildings and were used between sandbag layers to shut out the water

Maintenance men and executives likewise kept on 24-hour duty. Sandbaggers worked three 8-hour shifts. Throughout the flood a warning siren, to be used only if an uncontrollable break-through occurred, stood ready. Numerous buttons for operating the siren were spectacularly marked so they could be quickly located. Plant police supervised frequent test blasts. Fortunately the siren was not needed.

Welders, too, used their welding torches to fight the flood. When the river rise first appeared to be slight, but enough to flood an adjacent residence area of about 20 all-steel, prefabricated homes built by us before the war, welders placed waterproof sheets of thin steel 2 feet high across the doors. Later, as the river continued to climb, these homes, cleared of occupants and furnishings, had to be flooded to keep them from popping up and floating away. All-steel, welded, box-like sandblast and boiler rooms inside the plant itself likewise were flooded sufficiently to keep them from floating.

In cleaning up after the flood the tons of sand emptied from the sandbags were put into big piles. The sand will be used again, for previously planned construction jobs.

The sandbags, mainly burlap, had to be dried as soon as they were emptied of sand to keep them from molding and rotting. Originally costing 10 cents apiece, the cloth bags, as such would bring a salvage price of only a penny. Since machinists wiping rags are relatively expensive, the dried bags, cut into wiping strips, have almost 100 percent salvage value.

In at least one sense, the flood was a boon. Labor and management, having licked the flood together, are now even more firmly shoulder to shoulder in the fight to lick the Axis. Le Tourneau's Army-Navy flag symbolically flies higher than it did before the flood, thanks to that morale-inspiring experience.

When sheet steel doors proved inadequate protection, workers' all-steel houses were flooded to keep them from floating away

Laying Out the V-Belt Drive

G. A. VAN BRUNT, Associate Editor, *Factory*

A PROCEDURE recently devised by Allis-Chalmers engineers for calculating V-belt drives, and described here for the first time, will cut down the possibility of error and shorten the time ordinarily required. With this method all any designer considering V-belt power transmission needs to know are the fixed ratings and dimensions of the proposed drive.

The key to the new selection method is a chart, Figure 1 (to which the name "Econograph" has been given), for selecting driving sheave diameters and belt sizes—the most important considerations in the design of any V-belt drive. This chart consists of superimposed graphs bringing together six variables—horsepower per belt; velocity in feet per minute; driving sheave diameters between limits (these limits for each belt size are the smallest sheaves desirable for minimum belt bending stresses and the largest, beyond which belt horsepower cannot be increased without jeopardizing operative tensile strength); belt size; revolutions per minute; and number of belts or grooves. Supplementary charts to complete drive calculations are: A belt length selection chart, Figure 2; the ideal center distance multiplier chart, Figure 3; a service factor table;

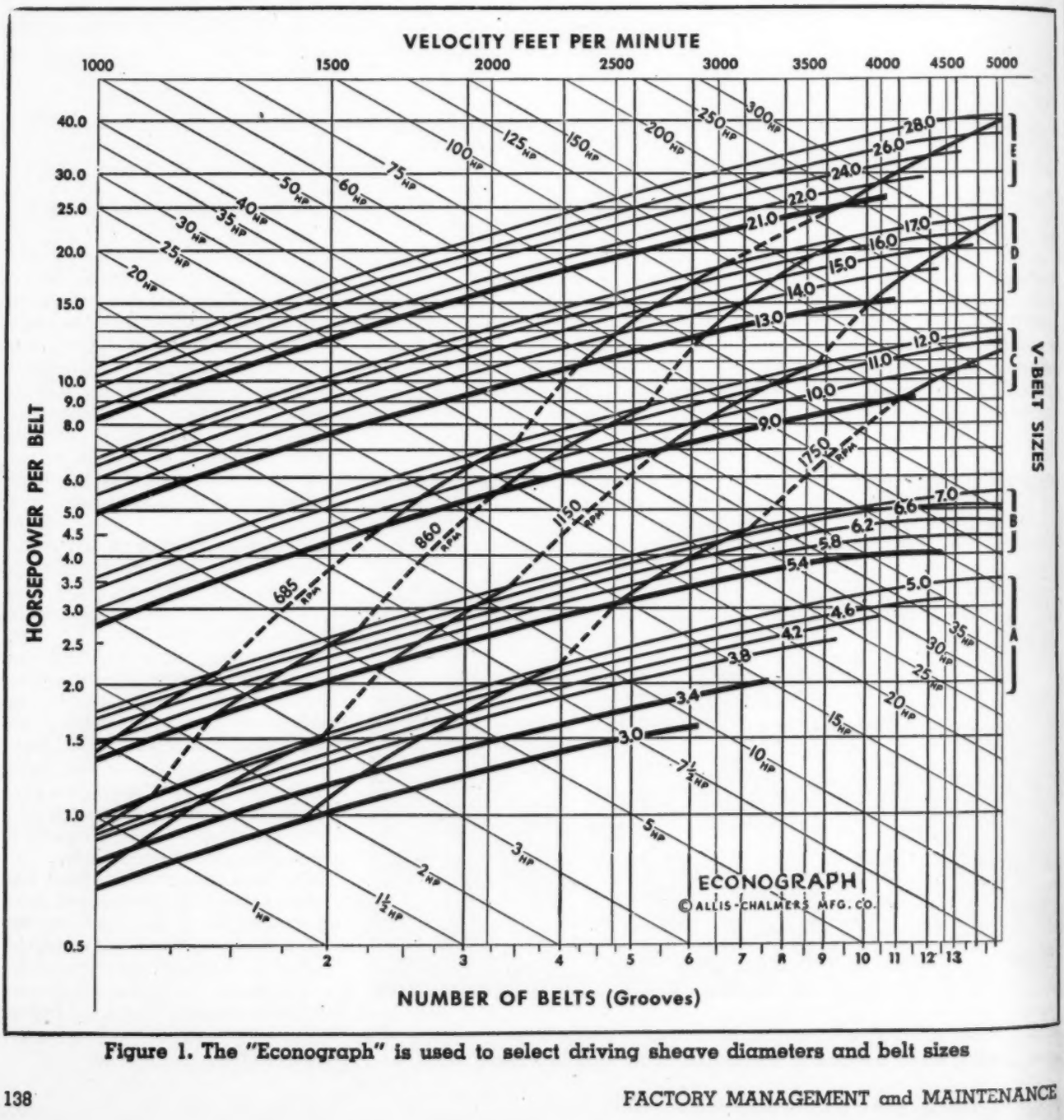


Figure 1. The "Econograph" is used to select driving sheave diameters and belt sizes

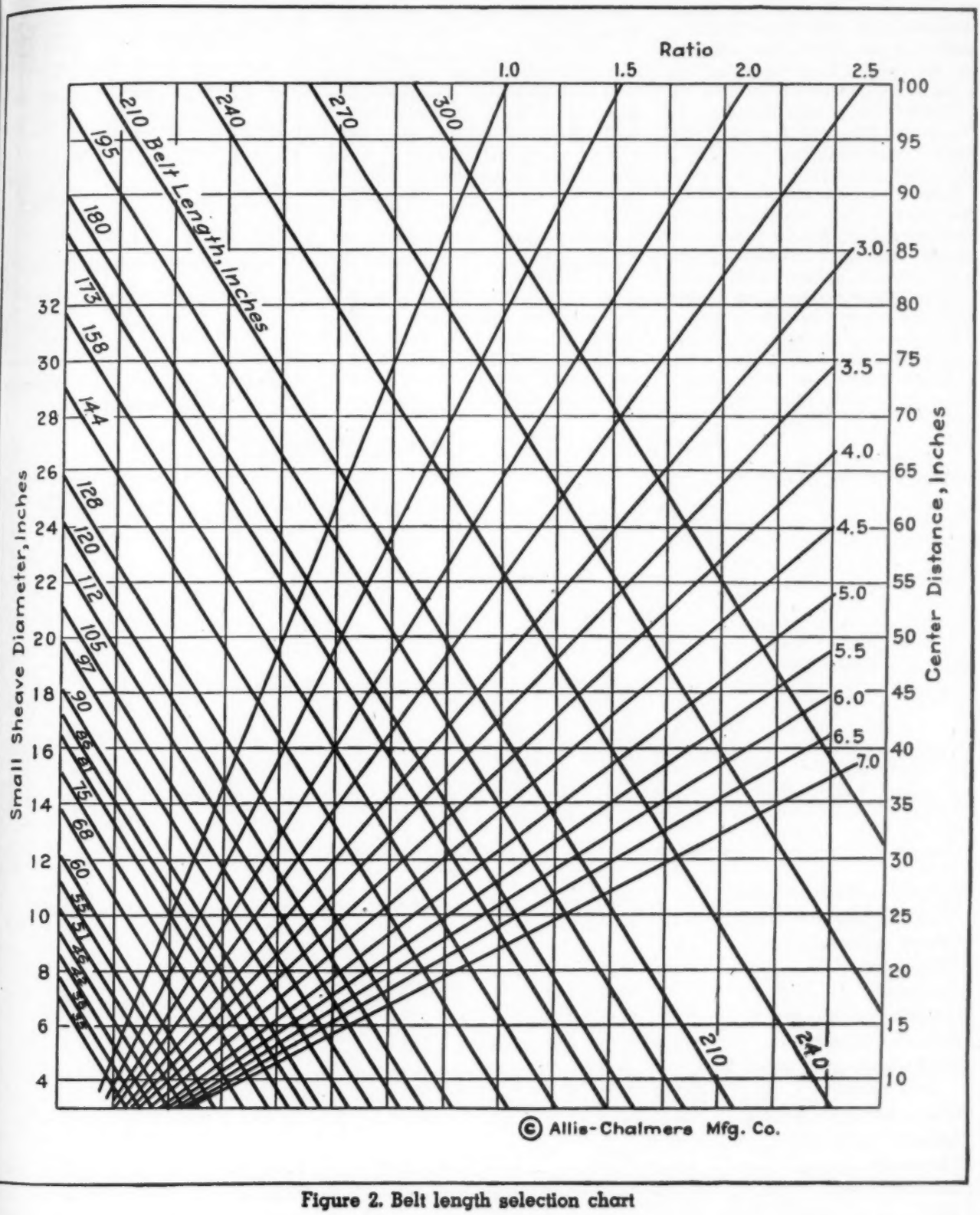


Figure 2. Belt length selection chart

and Figure 4, arc of contact correction chart.

These charts picture all available belt and sheave dimensions, permitting the best possible choice.

Selection of a drive depends first, of course, upon the known requirements. These are the speed and horsepower of the motor to be used (according to WPB Conservation Order L221, speed will be 1800 r.p.m. for drives up to and including 25 horsepower); the diameter of the largest driven sheave that can be accommodated; and the corresponding diameter of the small sheave required to suit the ratio desired.

As an example, a typical machine tool drive has been figured and plotted (Figure 5) on a portion of the chart shown in Figure 1, from which all extraneous lines have been removed. The known values in this problem are: A 20-hp., 1800 r.p.m. motor (1750 r.p.m. full-load speed); a drive ratio of 3.5 to 1; large sheave diameter limitation of 26 inches. Maximum diameter of driving sheave will then be 26 ÷ 3.5, or 7.4 inches.

Here is how this drive is figured: A

straightedge or a ruler is placed along the 20-hp. line. From the intersection of the 1750 r.p.m. line with the horsepower line, the r.p.m. line is followed to its intersection with the curved line indicating a 7-in. diameter sheave. At the right margin of the chart it is immediately seen that B belts must be used.

Now trace back horizontally from this point to the straightedge on the horsepower line. With a pencil point resting on this intersection, the straightedge is pivoted to a vertical position. Following down the straightedge, the number of belts is read at the bottom of the graph. Approximately 4.3 belts are indicated.

At this point the chart in Figure 1 makes it possible to consider other sheaves, smaller than one with a maximum diameter of 7.4 inches, in order to arrive at the most economical drive. Plotting smaller sheave sizes (as has been done on Figure 5) indicates that there are only two sheave sizes that will call for fewer than five belts. From here on only these two possibilities need be considered. The second is a 6.6-in. sheave, calling for 4.7 belts.

Next, select the corresponding center distances and belt lengths for drives with both 7-in. and 6.6-in. sheaves. To get the center distance a multiplier that will convert the large sheave diameter to the ideal center distance is chosen from Figure 3. As will be seen, it is 1.25 for a 3.5 to 1 ratio. The ideal center distance will

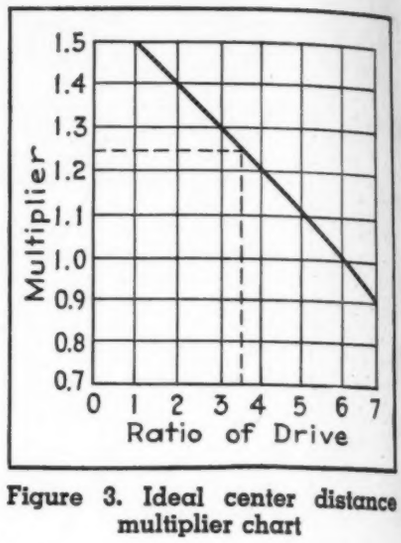


Figure 3. Ideal center distance multiplier chart

SERVICE FACTORS FOR V-BELT DRIVES

Applications	Electric Motors										Engines		
	A.C.								D.C.				
	Squirrel Cage				Synchronous		Single Phase						
	Normal torque line start	Normal torque compensator start	High torque	Wound rotor (slipring)	Normal torque	High torque	Repulsion and split phase	Capacitor	Shunt wound	Compound wound	Gas and diesel 4 or more cyl. above 700 r.p.m.	Steam	Lineshafts and clutch starting
Agitators-paddle-propeller	1.2	1.0	1.4	1.2	...	...	...	...	...	...	...	...	...
Brick and clay machinery	1.5	1.3	1.8	1.5	...	...	...	...	1.4	...	...	...	2.0
Bakery machinery	1.2	...	...	...	...	...	1.2	1.0	...	...	...	...	...
Compressors	1.4	1.4	...	1.5	1.5	...	1.2	1.2	1.2	...	1.2	...	...
Conveyors	...	1.6	1.8	...	...	...	...	...	1.6	...	...	...	1.8
Crushing machinery	...	1.4	1.6	1.4	1.4	1.6	...	...	...	1.6	1.6	...	1.6
Fans and blowers	1.6	1.6	2.0	2.0	2.0	2.0	...	...	1.4	...	1.6	1.5	1.5
Flour, feed, and cereal mill machinery	1.4	1.4	1.6	1.4	1.4	...	...	...	...	...	1.8	...	...
Generators and exciters	1.2	...	...	...	...	...	...	...	1.2	...	2.0	1.4	1.4
Laundry machinery	1.2	...	...	...	...	...	...	...	...	1.2	...	...	...
Lineshafts	1.4	1.4	...	1.4	1.4	2.0	1.4	1.4	1.4	1.4	1.6	1.6	1.6
Machine tools	1.2	...	...	1.4	...	...	1.2	1.2	1.2	1.2	...	...	...
Mills	...	1.6	1.6	1.4	...	...	...	...	...	1.4	...	...	1.6
Oil field machinery	1.2	1.2	1.4	...	...	...	...	...	1.4	1.4	1.4	1.4	1.6
Paper machinery	1.5	1.4	1.8	1.5	1.6	1.8	...	...	1.5	1.5	...	...	1.8
Printing machinery	1.2	1.2	...	1.2	...	...	...	...	1.2	1.2	...	...	...
Pumps	1.4	1.4	1.4	1.6	1.6	1.8	1.2	1.2	1.2	...	2.0	2.0	...
Rubber plant machinery	1.4	1.4	1.4	1.4	...	1.8	...	...	...	...	...	2.0	...
Screens	1.2	1.2	1.4	...	...	...	...	...	...	...	...	...	...
Textile machinery	1.6	...	1.8	...	...	...	...	...	...	...	...	...	...

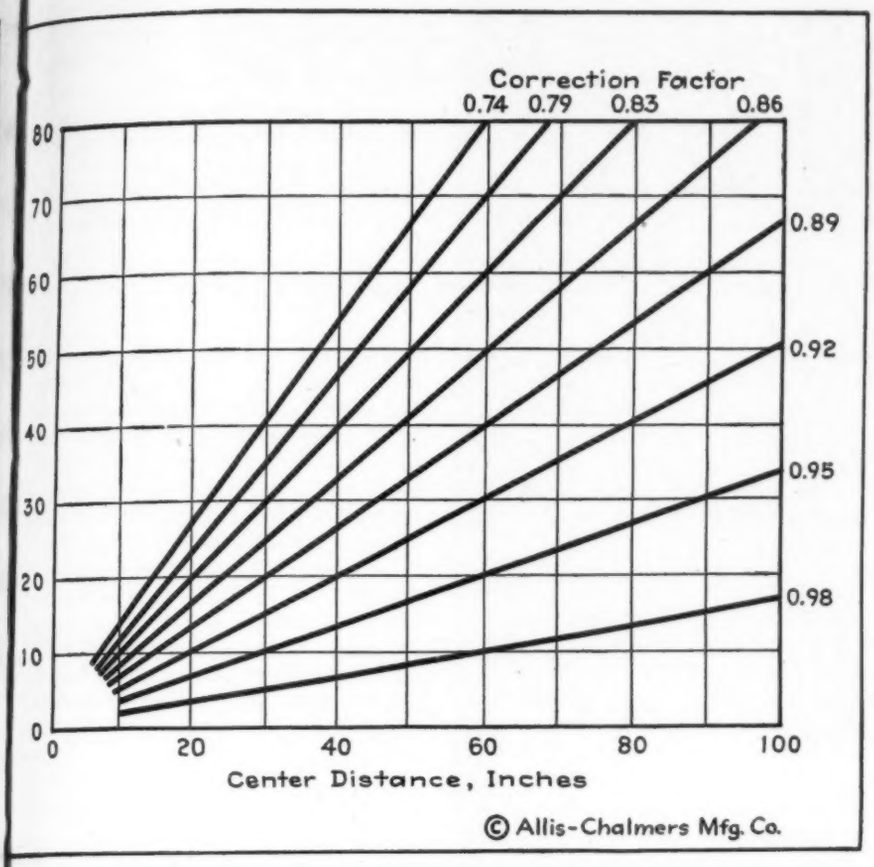


Figure 4. Arc of contact correction chart

therefore be 1.25 times the diameter of the sheave. With the 7-in. driving sheave the diameter of the large sheave will be 7 x 3.5, or 24.5 inches. If a 6.6-in. driving sheave is used the large sheave will be 6.6 x 3.5, or 23.1 inches in diameter. The ideal center distances for these large sheaves will be, therefore, 30.6 and 28.9 inches, respectively.

Proceeding to the belt length selection chart (Figure 2), lay the straightedge to the left of and vertically through the point where the 3.5 to 1 ratio line and the 7-in. sheave line intersect. Locate the 30.6-in. ideal center distance for the 7-in. sheave on the right ordinate of the graph, and project horizontally, left, to the straightedge. A point is now located between the 105- and 112-in. belt lines. Select the shorter of the two.

To use the 105-in. belt length, drop vertically to that line, then horizontally to the right, and read the correct center distance of 27 inches.

The same belt length (105 inches) is used to arrive at the correct center distance of the 6.6-in. drive. Lay the straightedge vertically through the intersection of the ratio and sheave lines (3.5 and 6.6). Follow the straightedge vertically to the 105-in. belt line, and project horizontally right to the correct center distance of 29 inches.

Calculations thus far offer a choice of two complete drives, and all that remains is to correct the number of belts for severity of service and arc of contact. Using the table of service factors and Figure 4, the service factor of 1.2 for machine tools divided by the arc factor of 0.89 for the 7-in. sheave results in a total correction factor of 1.35. For the 6.6-in. sheave, an arc factor of 0.91 gives a total correction of 1.32.

Correcting the original readings from Figure 1, the belt requirement for the 7-in. sheave is 4.3 x 1.35, or 5.8 belts. Since this is nearest the even number of 6, it is apparent that 6 belts are required for this drive. For the 6.6-in. sheave, the number of belts called for is 6.2. While this is greater than 6, wartime calculations permit the use of six, the nearest integral number of belts, so that this drive will have the same number of belts as the first.

Either of these drives will be more economical than any other for this application, because the minimum number of V-belts is used. In this instance, the drive using the 6.6-in. sheave will cost a few dollars less, but the 7-in. sheave drive will have greater horsepower capacity because the belts operate at higher velocity. Final choice can be made on this basis, keeping in mind that, when comparing for economy two drives using the same number of belts, the higher velocity drive is a better choice even at a slight price disadvantage because of its increased horsepower capacity.

With all the variations in drive characteristics for the hundreds of V-belt applications, the procedure just outlined will figure stock and standard sheaves and stock belts for the great majority of cases. The special characteristics of a relatively small percentage of drives may make it advisable to refer such problems to the manufacturer for calculation by V-belt engineers—for example, where center distances must be accurate to a fraction of an inch.

It is one thing to lay out a V-belt drive that will be satisfactory so far as pulling the load is concerned, but it is quite another matter to select the most economical drive for that application. Hasty selection of drives by the methods sometimes used may easily fail to give the most economical drive. Also, such additional possibilities for economy as might be achieved through slight modifications of machine and drive design may be overlooked.

Depending on the principles and care used in selecting V-belt drives, rubber—a critical material—can be wasted or conserved. Hence, drive calculations have assumed unusual importance. The method of selection described here has been worked out to give every consideration to the principle of designing drives for high belt velocities.

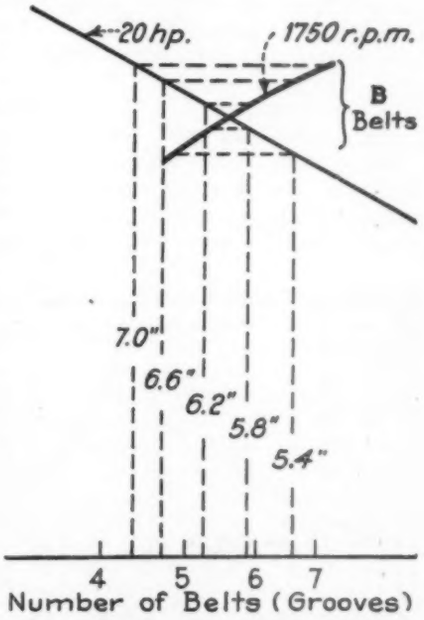


Figure 5. Plotting smaller sheave sizes indicates that only two sheaves sizes call for fewer than five belts

Adapting Series Motors to Special Jobs

R. F. EMERSON, Industrial Engineering Division, General Electric Company

THE SERIES MOTOR gets its name from the method of connecting its armature and field in series with each other as shown in Figure 1. The curve in this figure is designated as fundamental, because it is obtained without the use of any auxiliary resistance. This arrangement is used for all manner of traction drives and hoists—in fact, for all applications requiring the typical series motor speed-torque characteristic. A series motor will run away if the load is removed. This is indicated on the curve where the speed approaches infinity at zero load. Consequently it is imperative to connect a series motor solidly to its drive by a coupling, a gear train, or other means that will prevent the motor's being disconnected from its load.

To reduce the torque for starting purposes, resistance is inserted in series with the armature and field as shown in Figure 2. The resulting speed-load curve also is shown. If a starting torque equal to full-load torque is required, sufficient resistance must be inserted in series with the motor to limit the current at zero speed to its full-load value. Assume a 10-hp., 650-r.p.m., 230-volt motor has an armature and series field resistance of 1.124 ohms and a full-load current of 40 amperes. At 650 r.p.m. this motor takes no more than 40 amperes because it is generating sufficient counter electromotive force to hold the current to this value. At zero speed there is no counter electromotive force generated, and external resistance must be inserted in series with the motor to hold the current at 40 amperes.

How to obtain the value of this resistance? At zero speed, Ohm's law applies and the total resistance must be

$$R = E/C = 230/40 = 5.75 \text{ ohms}$$

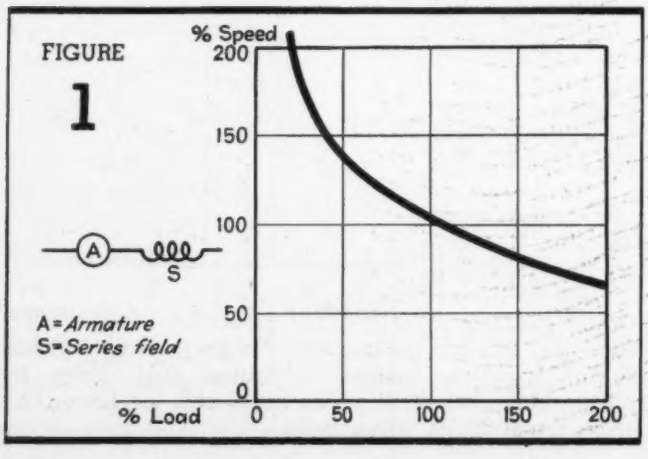
The quotient obtained by dividing line voltage by full-load current is called 100 percent ohms. For this particular motor 100 percent ohms is 5.75 ohms. Since the combined resistance of armature and field is 1.124 ohms, subtracting this value from 5.75 ohms leaves 4.626 ohms, which is the value of the external resistance required to get a starting torque equivalent to a 10-hp. load. If it is desired to lessen the starting torque on the first point of the controller, doubling the total ohms and subtracting 1.124 ohms internal resistance gives the amount of resistance required for 50 percent instead of 100 percent torque at starting. Conversely, if the drive has a considerable amount of static friction and more torque at starting is desired, it can be secured by reducing the external resistance.

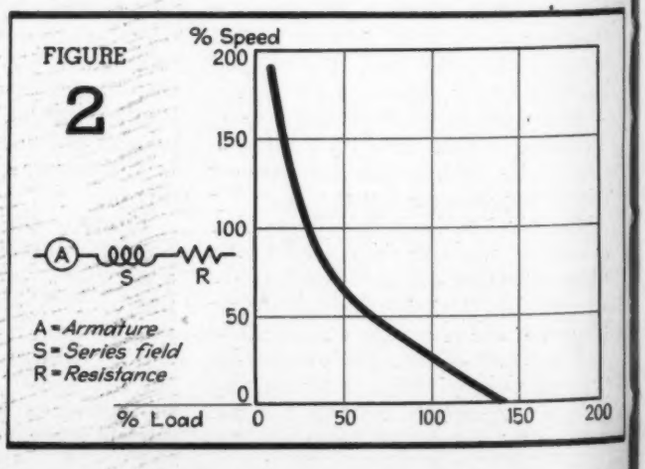
Figure 3 is similar to Figure 1 except that a resistance (R1) is placed in a shunt circuit around the armature. The resulting load-speed curve differs in that the motor no longer has the series motor characteristic of running away at no load. The load curve in this case crosses the zero load ordinate at point A. This change is important because many materials handling applications using series motors require a low speed at reduced loads.

In Figure 4 resistance R1 is added in series with the arrangement shown in Figure 3. A variety of curves depending on proportions of R1 and R2 are obtained. In Figure 4, Curve 1 shows 50 percent ohms in series (R1) and 50 percent shunted around the armature (R2). From the following table a load-speed curve for any series motor similar to one of the above can be approximated by first determining what 100 percent ohms is for the particular motor.

Curve	*R1*	*R2*
1	50% ohms	50% ohms
2	50% ohms	100% ohms
3	100% ohms	50% ohms
4	100% ohms	100% ohms

The amount of resistance (R1) in series tends to have greater effect at zero speed while the resistance (R2) in parallel with the armature tends to have greater effect on the speed at zero load. The ability to get reduced speed at light loads is made use of in hoist controllers for cranes. Controllers are sometimes designed so that the first point, or possibly the first two points, in the hoisting direction will use a shunted armature in order to get a slow speed with light loads on



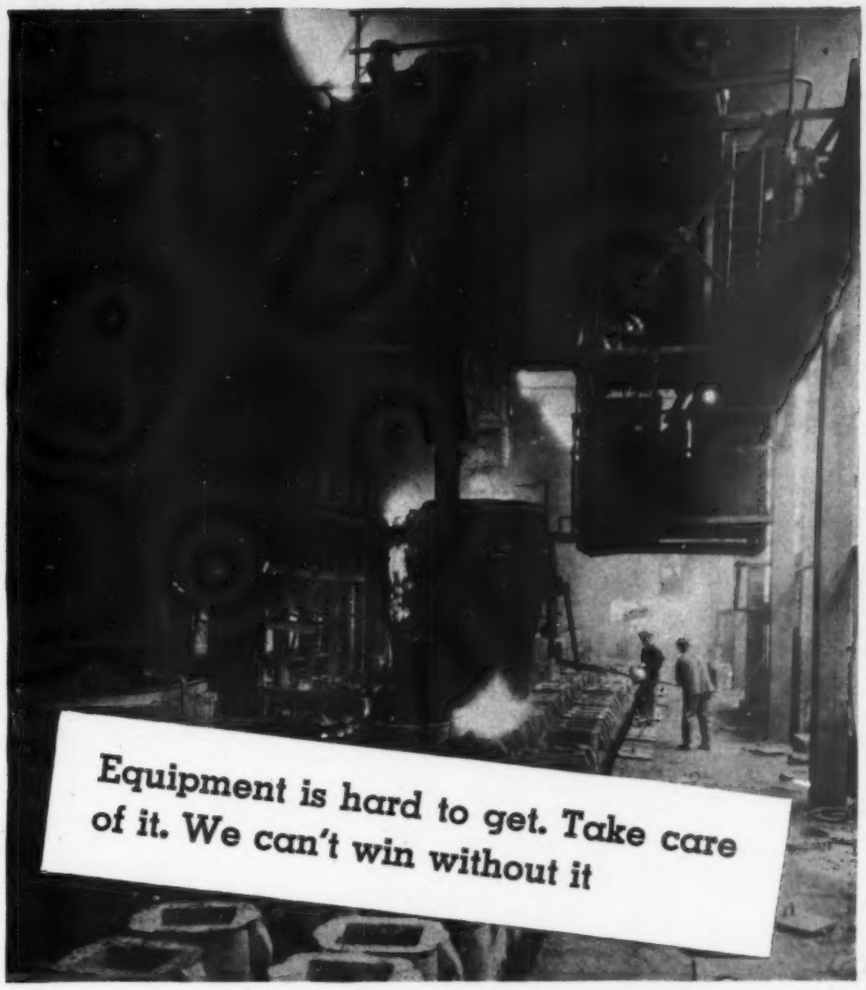


the hook. Figure 5 shows curves for a 5-point controller, the first two of which are for shunted armature points giving 30 percent and 72 percent speed at zero load. Curves 3 and 4 are for armature and field connected in series with a resistance as in Figure 2. Curve 5 is for the typical series connection with the series resistance cut out.

How to Retard

Retarding effect is obtained by merely bringing the controller back toward the off position. This is not necessary with a crane hoist. The load will stop because of the effect of gravity. For a high-inertia load, running at full-load, full-speed, the retarding torque is measured by the distance from point *A* to *B* or *C* when turning the controller to points on Curves 4 or 3 respectively. It can never exceed the amount of torque measured by *A* to *D* without the use of the shunted-armature connection. The amount of retarding torque obtained by going suddenly from the fifth controller position back to the first often results in too violent a shock to the driven equipment. A pause should be made on one of the intermediate points to allow the drive to slow down before dropping back to the first controller position.

The variety of speeds at various loads obtainable with the series motor is illustrated by the curves, Figure 6, which represent the resistor design for a small series motor used for driving a foundry car. The car was required to travel at a creeping speed of 17 feet per minute while sprinkling acid. The second operation required about half this speed for leveling off wet sand, and the load would be nearly five times that required for sprinkling acid. The third requirement was a speed of approximately 125 feet per minute when the empty



Ingot pouring operation requires a crane with seven series motors. The duty is heavy, but control must be precise and accurate

car traveled from one location to another. To meet the last requirement, gearing was necessary.

The full-load speed of the motor selected was 825 r.p.m. (point A, Figure 6), and the actual load on the motor to drive the empty car caused the motor to run at 1600 r.p.m. (point *B*) or about 194 percent of motor full-load speed. The creeping speed required 14 per cent of the high speed with practically the same load. Therefore point *C* was located as shown. Point *D* was located at 4.6 times the load of *C* and at one-half the speed. A line was drawn through points *C* and *D* and a 35 percent resistance (*R*1) in series with motor and 20 percent resistance (*R*2) in parallel with the motor armature were com-

FIGURE 3

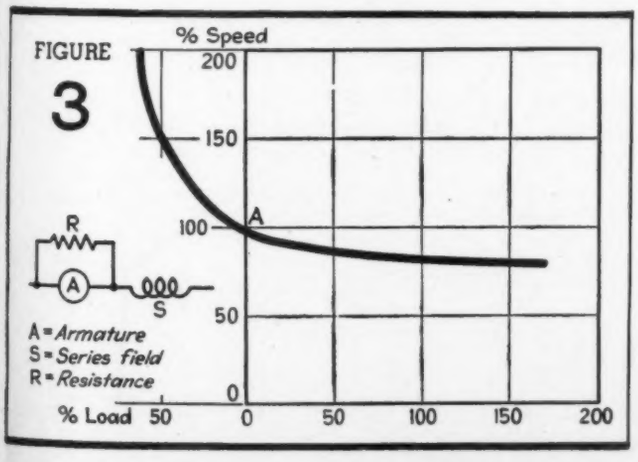
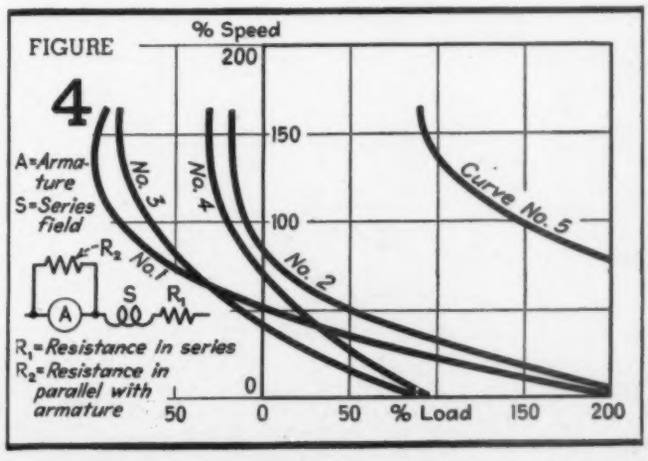


FIGURE 4



puted. Other curves representing acceleration points are omitted.

Because the required car speed for spreading sand was somewhat slower than that for sprinkling acid, it was possible to get both requirements from the same controller position. Two controller points would have been necessary had the sand-spreading operation required a higher speed than that needed for sprinkling acid.

Occasionally an improper gear ratio selected for a series motor is based on rated speed instead of the speed existing under actual load conditions. This invariably results in too high a speed on the driven machine. The proper way to correct this condition is to change the gear ratio. If this is not feasible, the speed can be reduced by shunting the armature with resistance. A loss of power in the form of heat in the resistor and series field results.

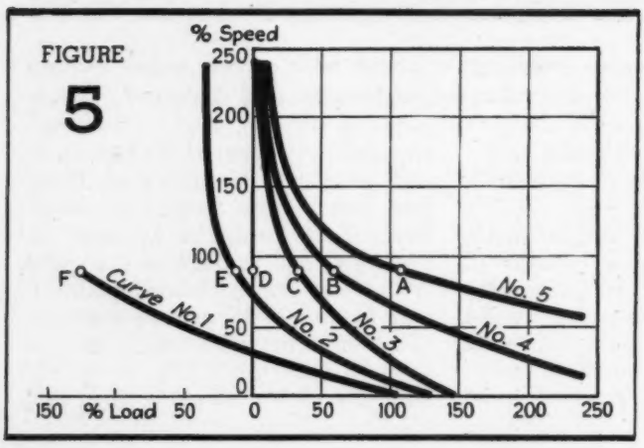
It is feasible to obtain shunt-motor characteristics with a series motor merely by shunting the field across the armature (Figure 7), exactly as is done with a shunt motor. Since the series field has a low resistance it is necessary to have a permanent resistance in series with it to hold the current to a reasonable value. This is less economical than using a shunt winding of high resistance. However, if a certain drive must have a motor with shunt characteristics—pump, conveyor, fan, or similar equipment—it is feasible to utilize an available series motor with this connection for such service.

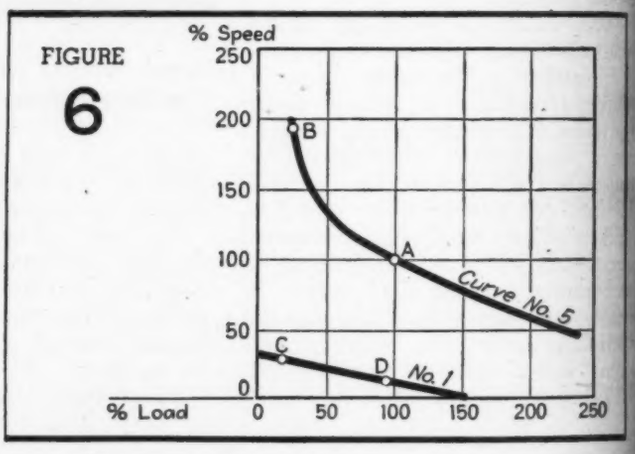
This connection has wide use for dynamic braking of descending loads on a crane hoist. Reduced speeds are obtainable by putting resistance in series with the two parallel circuits. The connection has the additional characteristic of flattening out in the dynamic braking quadrant instead of curving up as shown in Figure 3 for the shunted-armature connection, indicating that, no matter how great a load is lowered by the crane hook, it will not overspeed the hoist motor to a dangerous degree.

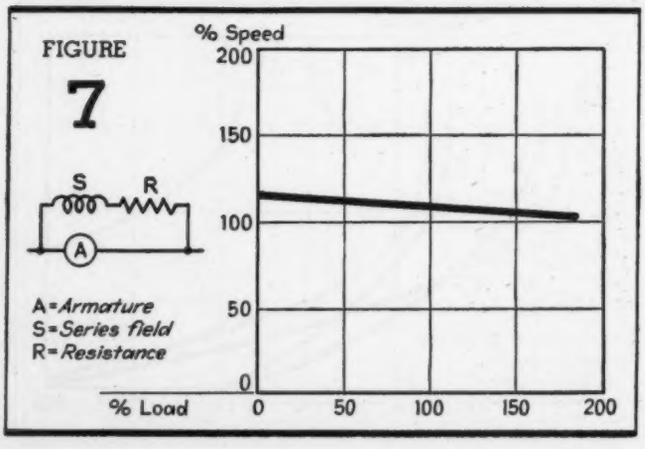
With a drive consisting of an overhauling load, such as a continuous flow of material carried down grade on a belt or a bucket conveyor, it is possible to improvise an efficient brake for maintaining fairly constant speed. Use a series motor without any electrical power supply whatever, as shown in Figure 8, with the armature, series field, and resistance all connected in series with one another. The descending load causes the motor to increase its speed until a critical value is reached. At this point the residual magnetism in the field causes a voltage to be generated, and a current is circulated through the loop circuit. The motor operates as a series generator. Since no electrical power is available, it cannot run as a motor. Consequently, if the descending load cannot start overhauling the drive, some auxiliary means must be used for getting the drive into motion.

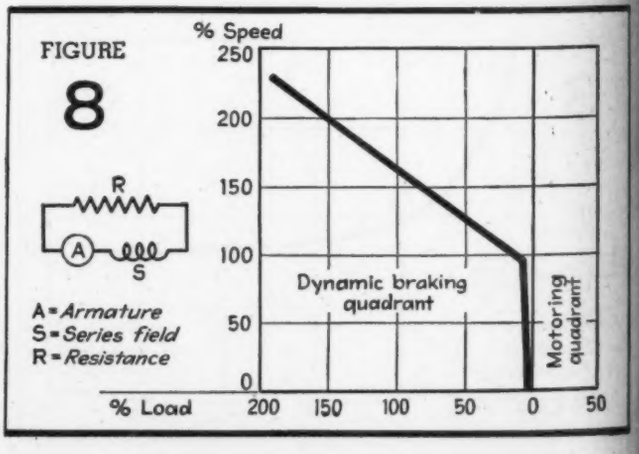
If the drive is similar to that of a retarding conveyor, always shut down while fully loaded and held by a brake, it will be in a favorable condition to resume operations when the brake is released. An advantage of this braking system over a mechanical brake equipped with brake wheel and brake shoes, is the elimination of brake linings and adjustment. The speed-torque curve, Figure 8, shows fairly good speed regulation, at 100 percent speed and 100 percent torque. If the gear reduction of the drive can be arranged for a lower motor speed, better regulation is obtainable. There must always be enough residual magnetism in the field poles to allow the voltage to build up.

This connection is also used as an emergency dynamic braking circuit for many hoists. When the controller is thrown to the "off" position, or if electric power should fail, this connection is automatically made and any load will be safely lowered.









Our Wartime Upkeep Policy

GEORGE E. PIRMAN, Superintendent, Atlas-Boxmakers, Inc., Chicago

As soon as this country got into the war, it became apparent to the management of Atlas-Boxmakers, Inc., that repair and replacement parts would be increasingly hard to get, and that probably many substitutions of inferior parts would have to be made. We decided, therefore, to "conserve present equipment to the fullest extent," and to that end took five steps to strengthen our maintenance routine:

1. Told foremen and supervisors what we were facing, and asked for their wholehearted cooperation.

2. Directed foremen and supervisors to clean up all mechanical equipment thoroughly, and to inspect it for flaws, worn parts, and small breaks. Where defects were found, replacements or repairs were made.

3. Gave instructions to paint all equipment with a good grade of machinery paint.

4. Issued orders that machines were not to run at top speeds. Vibration and undue wear from top-speed operation were thereby reduced.

5. Insured our machinery against breakdowns. This we consider the most important of the precautions we took. The insurance was placed with one of the large companies, and it gave us the benefit of outside, expert inspection. Outside inspections keep the foremen on the alert, because they do not want to be shown up to a strange inspector, and the inspectors make their recommendations impersonally.

★ The well-maintained plant is the high-production plant

These steps supplement, but did not supplant, our normal maintenance program. Each of our two plants has a maintenance foreman, who is on call at all times, and to whom the production foremen report need for maintenance work. We do not maintain elaborate repair or machine shops, but have contracts with several organizations that do our repair work.

We use the best of oils and greases for lubrication, and see that they are applied in accordance with the machinery builders' recommendations. Cutting knives are ground periodically. Belts are kept snug and dressed. Motors and machines are blown free of dust every night by compressed air, and are cleaned thoroughly at the end of each week.

In our regular foremen's meetings, maintenance problems are discussed. We point out that equipment we now have must be used carefully, because a badly damaged machine not only cannot be replaced, but also delays by that much the total war effort. Our program is proving successful, and we continue to try to impress the foremen at each meeting with the importance of hewing to the line.

All mechanical equipment was thoroughly inspected. Necessary repairs were made and a good grade of machinery paint was applied

The best grades of oil and grease are used and manufacturers' lubrication instructions are scrupulously followed

At the Milwaukee Fire Department's school, industrial firemen get practically the same training as regular city firemen, but do not work on ladders more than 30 feet long, on towers, or on fireboats

School for Plant Firemen

AN ALARM SOUNDS. In a few seconds battle stations are manned. Trained men are ready to meet a tricky enemy which makes its own rules, gives no quarter, fights to the bitter end.

The locale might be a battleship, but it isn't. These fighters wear shop clothes, badges, and arm bands instead of uniforms. Their weapons are fire extinguishers, hose, gas masks. Organized as fire brigades, they can be found in 75 percent or more of Milwaukee's industrial plants, because these plants are carrying on an all-out war on one of their most deadly enemies—fire.

It's all the result of an idea that took form in the mind of an implacable enemy of fire, who has spent 31 years in fighting it with every facility at his command.

Back in 1940, when the smoke of burning Europe began to cause uneasiness here, Chief Peter Steinkellner of the Milwaukee Fire Department began to speculate on what might happen if we were drawn into war. Farsighted, he could visualize something of the tremendous demand for war matériel. With its many large factories Milwaukee obviously would play a vital role in helping to arm our forces and those of our allies. New plants would be built, old ones enlarged, thousands of new employees hired. Hazards would be increased, and fires would take on a new significance.

Normally, when an industrial plant has a bad fire the owner, the employees, and the insurance company suffer a loss, perhaps a disastrous one, but the welfare of the country is not seriously endangered. In wartime it is different. Every industrial fire is likely to mean the loss of critical materials that cannot be replaced, and a delay in the production of the weapons by which our liberties can be safeguarded.

Milwaukee has nearly 300 large and medium-sized industrial plants scattered over an area of nearly 45 square miles. That is a lot of territory. Chief Steinkellner knew that the 800 men in his department could be depended upon to give the last bit of their strength and skill in protecting the city's industries, but would their all be enough under every possible condition? What answer he gave to that question does not matter. What does matter is that he decided to strengthen the city's fire defenses, and those of the entire county as well.

Surrounding the city of Milwaukee there are, in Milwaukee County, some 15 small cities, towns, and villages, each with its own fire department. Several of these municipalities have highly important industrial facilities within their borders. It was necessary that steps be taken to assure appropriate fire protection to any industrial

STATE OF WISCONSIN

COUNCIL OF DEFENSE

Reposing special trust and confidence in the patriotism, valor, fidelity and ability of

JOHN DOE

HE *is hereby appointed*

An Industrial Auxiliary Fireman of the Milwaukee County Council of Defense

and is charged with the responsibility of carefully and diligently following and executing instructions and duties as designated by duly constituted authority at all times and to the limit of ability

This appointment made on the 23RD *day of* JUNE *in the year of our Lord one thousand nine hundred and forty-two* ~~two~~ *three.*

Gus A. Leavitt, Chairman — Walter J. Goodland, Secretary

John L. Bohn, Asst.

Training completed, industrial firemen get certificates from Wisconsin Council of Defense

facility within the county, regardless of its location.

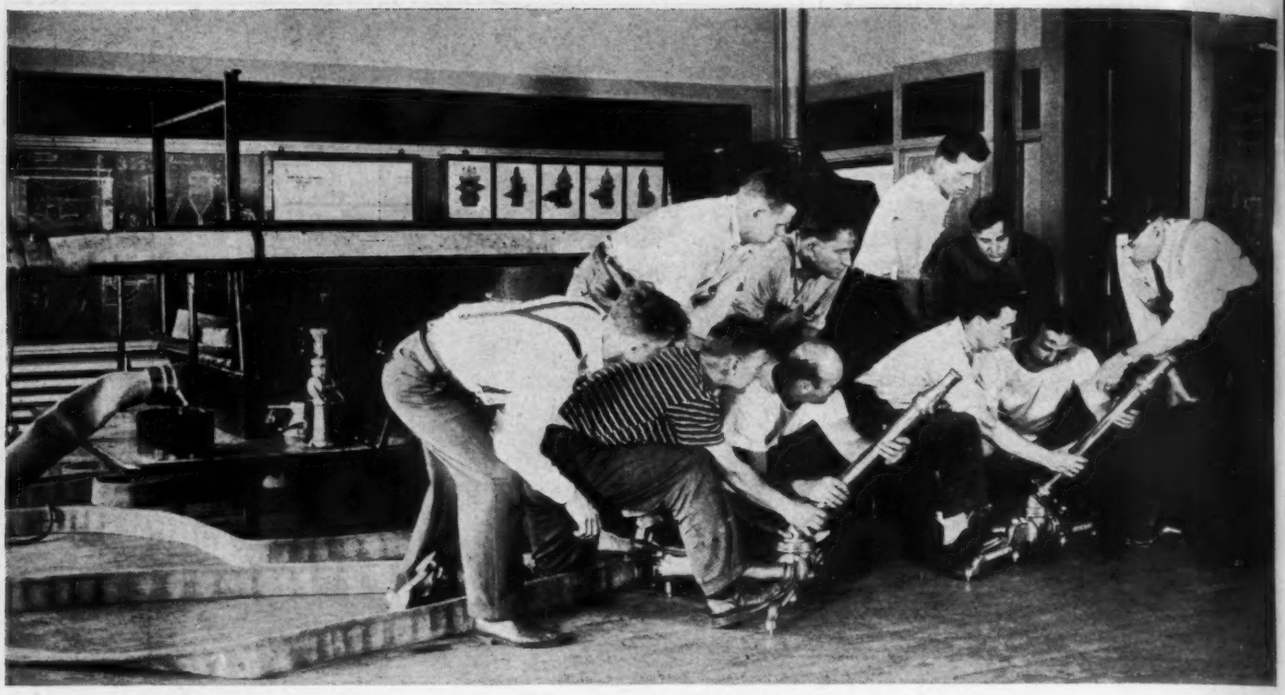
One of the first steps, then, was to organize the fire chiefs of the county into any organization now known as the Milwaukee County Association of Fire Chiefs, of which Steinkellner was elected president. The object of this organization was to bring about a reciprocal agreement among the big town and its satellites, whereby in emergencies each could extend aid to the other. To do this, the fire chiefs of the county subdivisions appeared before their respective lawmaking bodies with requests that resolutions be enacted empowering the chief of any fire department to pool his firefighting forces and equipment with that of any other fire department in the county. The chiefs of all fire departments within the county now have that authority.

In common with all big cities, Milwaukee has for many years had a good school for training new firemen. The fire chiefs in the county association were invited to send their department instructors to the Milwaukee Fire Department Bureau of Instruction and Training to take the city fire department training course, and did so. This course extended over a period of 60 working days. As a result of this training, uniformity of procedure extends even to the way in which tools are stowed on the fire apparatus. That saves time when fighting fires.

Organizing for the Job

This was a good beginning, but Steinkellner felt that more must be done. The county's industrial plants must be helped to help themselves. Prior to Pearl Harbor, twelve plants in the city of Milwaukee had some kind of fire brigade, as did a few plants in the suburban areas. Most plants, of course, had extinguishers and possibly a hose line or two. But the fire chiefs, with their many years of firefighting experience, first as smoke-eaters and then as executives, knew that in an emergency untrained workers tend to get panicky and are more likely to do the wrong thing than the right. Incidentally, it was found later than 70 percent of those who enter the training course for industrial firefighters do not know how to operate a fire alarm box or telephone in an alarm properly. Since the action taken in the first few minutes determines pretty well whether a fire will be merely a nuisance or a disaster, the fire chiefs knew that training plant personnel in firefighting must be the next step in the program.

A questionnaire was sent to 200 of the leading plants in Milwaukee county. Among the questions asked was whether the plant had a fire brigade, and whether the management would like to have the fire department assist in training employees in fire prevention and firefighting. Also whether the managements would consent to an inspection of their plants by fire department officers, not for the purpose of finding fault but merely to offer suggestions for the improvement of firefighting facilities within the plant. There was no persuasion, and there were no arguments or selling talks, but 170 plants said they would like to have help. Fire department officers were thereupon detailed to make inspections. Reports were submitted to the chiefs, who checked them and



Since the school was opened 18 months ago, more than 10,000 persons have been trained in firefighting

then submitted to the industrial concerns detailed suggestions for improvement of the firefighting facilities within their plants.

Next the key men who would be held responsible for the fire safety of their plants were invited by the Milwaukee County Association of Fire Chiefs to become associate members. At the first joint meeting the splendid turnout made it obvious that the plan of organizing industrial fire brigades could not fail.

In August of last year the industrial fire chiefs decided to form their own organization, the Milwaukee County Industrial Fire Chiefs Association.

Its purposes are: (1) To make it easier for the members to help one another in any problems relating to plant protection; (2) to cooperate with the municipal fire departments, the armed services, and the law enforcement officers. Each member is pledged to be ready for duty whenever needed, and to do all in his power to see that production lines are kept going day and night. Membership now is 360.

It seemed certain that the regular firemen's training school would be inadequate to handle all those who wanted training. Also, it was apparent that the course would have to be revised to include some new subjects, such as arson, sabotage detection, and chemical warfare, which wartime conditions have made important.

The details of preparing the courses and organizing and conducting the school were assigned to Assistant Chief Edward E. Wischer, an able and experienced officer, and an enthusiastic advocate of training in industrial fire prevention and firefighting. It was a difficult task which had to be done under handicaps that might have dampened anyone's enthusiasm for the job. In accomplishing this task Wischer had the assistance of Captain Muenzenberger, an instructor at the Bureau of Instruction and Training.

Space had to be found where large classes could be accommodated and demonstrations conducted. The Milwaukee School Board turned over to the fire department a small building.

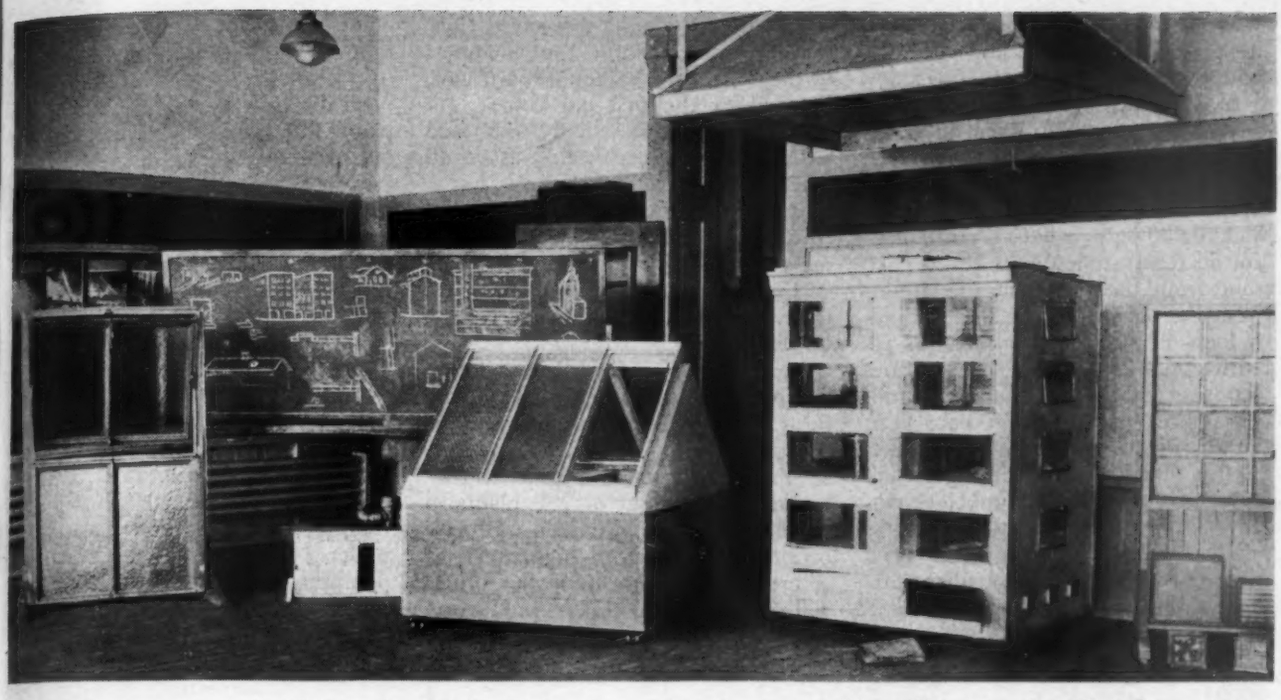
Preparing the Courses

Extinguishers, tools, and equipment of various kinds had to be obtained for training and demonstration purposes. That, too, was a problem, because priorities and scarcities were beginning to pinch, and money to purchase the needed items was inadequate or non-existent. To bridge this gap the Milwaukee County Association of Fire Chiefs petitioned the Milwaukee County Council of Defense for funds with which to purchase the equipment that could be obtained. Upon recommendation by the Milwaukee County Council of Defense, the Milwaukee County Board of Supervisors voted the sum of $30,000 for the purchase of firefighting training equipment to be allotted to all the fire departments within the county subdivisions. Equipment that could not be purchased was either lent or donated to the fire department's school by the local utilities and industrial plants, upon the request of Chief Steinkellner and Assistant Chief Wischer. Some things that could not be obtained otherwise were made in the fire department's repair shop. Today the school is well equipped.

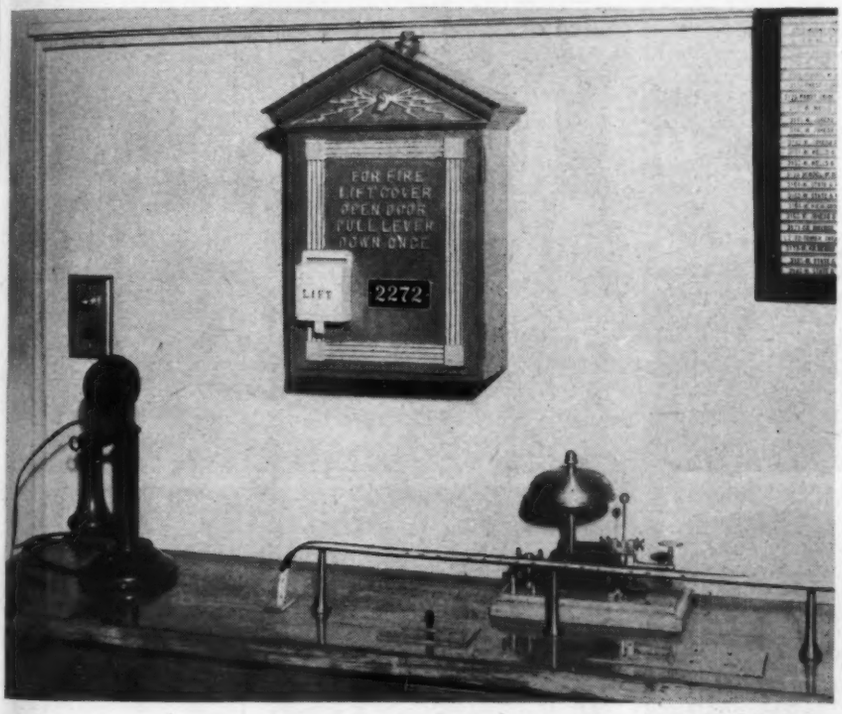
The task of preparing the courses was arduous. To be sure, the old instruction sheets that had long been used for training probationary and regular firemen were still available, but they needed revising and, as said before, some new subjects had to be included. The job had to be done right, and fast. Wischer went after it with characteristic wholeheartedness. To meet the first requirement he supplemented his practical firefighting and fire prevention experience with full-length courses at the New York City Fire College, the Army Chemical Warfare School at Edgewood Arsenal, the Purdue University Teacher's Training Conference, the Wisconsin Gas Specialist School, and the Army Bomb Reconnaissance School.

The second requirement—speed—was met very effectively by working upward of 16 hours a day.

In addition to Assistant Chief Wischer and Captain Muenzenberger, two other instructors, Captain Walter Zillmer and Lieutenant Alvin Dietz, were appointed. In an emergency, and one comes along frequently, as many as necessary of the 45 captains and 63 lieutenants in the fire department can be called on to lecture or conduct a demonstration. Any fireman, too, may be required to lend a hand when-



To house the course, the Milwaukee School Board turned over a small building to the Fire Department



Seventy percent of trainees do not know the right way to operate a fire alarm box or telephone an alarm. Here they learn how

ever and in whatever way he can be of help.

Classes are conducted from 8 a.m. to 10 p.m. With the present facilities seven groups can be handled at one time. Usually a class numbers anywhere from 10 to 40 persons, which is about all that can be accommodated conveniently in the regular classroom.

The school started to train its first class of industrial employees in January, 1942. At first the training course consisted of 14 sessions of 2 hours each for a total of 28 hours of instruction, but it was later found advisable to reduce the number of sessions to 11, making a 22-hour course. An outline of the course is given on page 151.

The course has not been sugar-coated in any way for the industrial firemen. It involves practically the same training that is given to city firemen. One of the chief differences is that the industrial firemen are not required to work on ladders more than 30 feet long, or to take training on the tower. Also, industrial firemen are not required to work on high-pressure lines or on fireboats.

In all other respects industrial firemen and city firemen get the same basic training. So far as the industrial firemen are concerned, the purpose of the training is not, of course, to make them professional firefighters. Nor is it supposed to render them and the plants in which they work independent of the city fire department. The principal objectives of the training course are:

1. To train the men to look for and know how to recognize and to correct hazardous conditions.

2. To enable them to take the proper action immediately on the occurrence of an emergency so that they may be able to extinguish a blaze or at least keep it from spreading until the city firemen arrive.

3. To enable them to work with and assist the city firemen.

Since under OCD rules no recognition was given to industrial fire brigade members, the Milwaukee County Association of Fire Chiefs, by special arrangement with the Wisconsin Council of Defense, has made it possible for the industrial auxiliary firemen to be graduated after eleven weeks of training. They are presented with a certificate of graduation issued

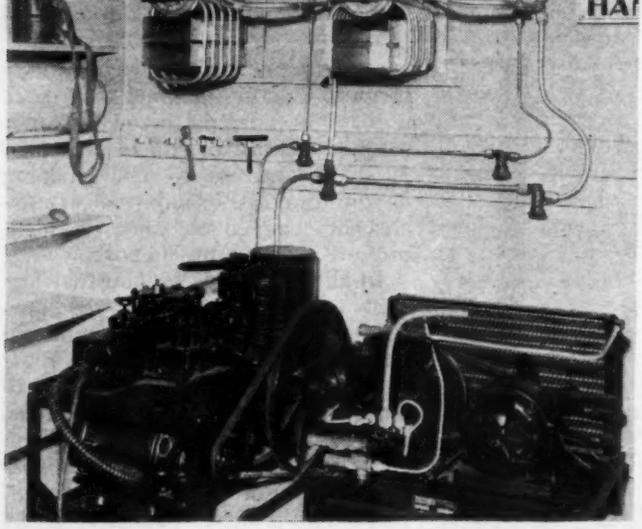
by the Wisconsin Council of Defense, an identification card, and an arm band, enabling them in an emergency to traverse the highways when called upon or to return to their place of occupation if so required.

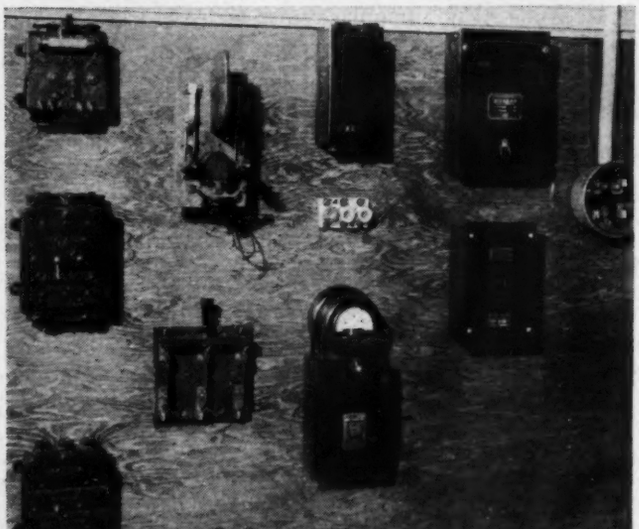
Since the school was opened to the public a year and a half ago, more than 10,000 persons have been trained. Not all these students, however, have come from the manufacturing industries. For example, 5028 employees of local utilities were given this intensive training under the utilities section of OCD. Many auxiliary military police (plant guards) have been trained in fire prevention and firefighting under the direct supervision of the Army. A large number of employees of stores and other business establishments likewise have been trained. In addition, all auxiliary firemen enrolled in the Milwaukee Civilian Defense Corps have received their training there, while the members of the City Air Warden Service have been given the first aid course. All instructors of the school carry Red Cross instructor certificates, as do all officers of the fire department.

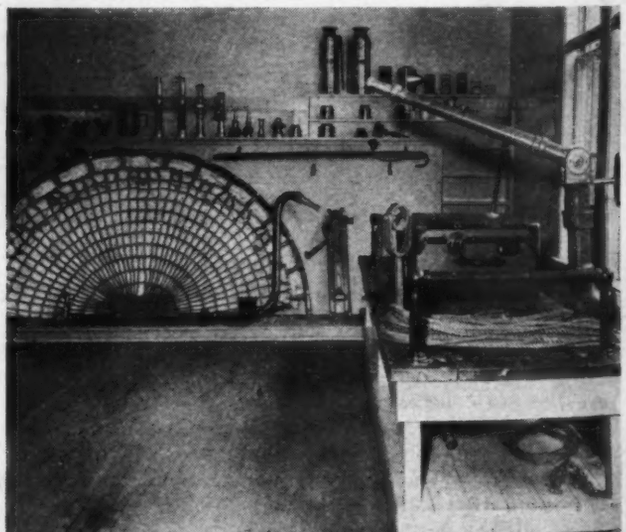
It has been the policy of the school from the beginning to give the training course free to anyone who wants it. Fire departments from many states have sent their officers to the school for training.

Industry's response to this invitation has been so enthusiastic that 160 industrial plants have sent key men to take the training course, many plants sending the entire fire brigade. In Milwaukee county, out of 280 plants in which the Army is interested, 210 have organized a force of firefighters. It is expected that most of the others will do likewise. All war production plants and facilities under the jurisdiction of the Sixth Service Command for continuing security protection have been directed to organize and train a plant fire brigade within their own organizations.

Cooperation between Milwaukee's industrial plants and the city fire department in strengthening the community's fire defenses has been wholehearted, and profitable to both. For example, it was made known that the city fire department could make good use of more vehicles, which are difficult to obtain. Here was something that the local plants could do something about. Thus far they have turned over to the fire department, either as outright gifts or for the duration, 30 trucks of 1½- to 3-ton capacity, 13 trailers, to be used for mounting pumping units, and 5 coupes. These vehicles have been or are being re-







Firefighting training equipment presented a problem. It was solved by buying what could be obtained, borrowing from local utilities and plants, or making the equipment in the department's shop

DRILL PRACTICES FOR INDUSTRIAL FIREMEN

Outline of 22-Hour Course

1. Transmitting fire alarms — *2 hours*

A. Fire alarm
   a. Transmitting alarm by telegraph
   b. Transmitting alarm by telephone
B. Electric, gas, water, and refrigeration shutoffs
   a. Types of appliances
   b. Precautionary measures in dealing with appliances
   c. Shutting off the systems

2. Lecture and demonstration. Fire extinguishers — *2 hours*

3. Lecture. Ventilation, arson detection, and salvage — *2 hours*

4. Lecture. Controlling incendiary bombs and protection against high-explosive bombs — *2 hours*

5. Lecture. Protection against war gases — *2 hours*

6. Lecture. Protection against sabotage bombs, and use of gas masks — *2 hours*

7. Fire apparatus, tools and equipment of the fire service — *2 hours*

A. Tools
B. Ladders
C. Hose and hose appliances
D. Ropes and knots
E. Rescue equipment

8. Hose practices — *2 hours*

A. Lay out line up inside stairway. (Reduce line and divide)
B. Insert form generator. (Explain)
C. Connect to siamese and Baker set
D. Lay out 3½-in. line from boat hydrant to street jack (Explanation)
E. Lay out 3½-in. line from hydrant. Reduce and divide to two 2½-in. lines

8A. Ladder practices*

A. Raise 14-ft. extension ladder
B. Raise 20-ft. straight beam ladder
C. Raise 25-ft. straight beam ladder
D. Raise 30-ft. extension ladder
E. Raise 40-ft. extension ladder
F. Practices: (a) carrying, (b) raising, (c) climbing, (d) safety features—use of roof ladders

9. Lay out 2½-in. line to cellar pipe — *2 hours*

A. Distributing nozzle, improvised cellar hitch, cock loft
B. Raise and extend 14-ft. extension ladder. Make stepladder

9A. Hose practices*

A. Taking line up fire escape to second floor landing and in on second floor
B. Connecting line to outside standpipe
C. Hoisting line to roof and upper floors
D. Taking line up ladder and fastening for work through window

10. Sprinkler systems — *2 hours*

A. Explain method of laying out line and connecting the sprinkler systems
B. Describe working method of various types of sprinkler systems
C. Layout 2½-in. line to inside standpipe and connect one section on second floor to work out of window

11. Rescue work — *2 hours*

A. Placing life net in service
B. Sliding down rope
C. Lowering or hoisting persons with use of life bag, life belt, life knot
D. Carrying person down ladder

11A. Lay out 2½-in. line and 1½-in. line (using water) with various appliances—spray nozzles, distributing nozzle, cellar pipe, and Baker deluge set*

* Weather conditions permitting lessons 8a, 9a, and 11a are incorporated in this schedule.

built in the fire department shop to fit them for their new services.

Cutler-Hammer, Inc., was one of the first of the large industrial firms in Milwaukee to set up its own fire brigade. This company operates three plants, the main works comprising 21 buildings. About 95 percent of all areas are sprinklered.

Formerly the maintenance force of 120 men had the responsibility of fighting any fires that started. They were provided with extinguishers and were trained in using them.

Shortly after Pearl Harbor an air warden service of 300 men and women was organized. It was also decided about that time to strengthen the fire-fighting forces of the three plants. In consultation with the chief air raid warden and the foremen of the production departments, 71 men were invited to become members of the fire brigade. These men were very carefully selected from the standpoint of dependability, cool-headedness, physical strength, and their location in the plant. All these men took the Milwaukee Fire Department's course.

Fire defense activities are headed up by a chief who reports to the plant engineer. The fire brigade at the main works consists of 40 men, spread over three shifts. Over them there are 9 captains and 9 lieutenants. At the Orchard plant the brigade comprises 26 men on the three shifts, directed by 3 captains and 3 lieutenants. The foundry has 5 men for the one shift, under a captain and a lieutenant.

Incidentally, the captains and lieutenants are elected by the members of the brigade.

Drills are held once a month outside of working hours when possible.

Several men have been especially trained to handle the sprinkler system. They know the location of all sprinkler valves and how to operate them; also how to shut off individual heads. Shutting off the entire sprinkler system is forbidden, however, until ordered by an officer of the Milwaukee Fire Department.

All fires must be reported to the maintenance department.

Every six months during a practice

There's no wild scramble for equipment if an emergency occurs at Cutler-Hammer. Everything is in its right place, for a quick grab

session the chief makes each member of the brigade report a mythical fire to that department. The person receiving that report repeats it back for accuracy. All members are also required to summon the Milwaukee Fire Department in the three ways that are available:

1. Through one of the ADT boxes that are scattered through the plant

2. By pulling one of the city fire alarm boxes outside the plant

3. By telephone

All brigade members have been instructed that, if a blaze can be covered by a man's coat, they may attempt to put it out unaided. If it is larger, the city fire department must be summoned at once.

The brigades are, of course, well equipped with firefighting apparatus. Large numbers of extinguishers of the types and sizes suitable for the hazards are located at convenient points throughout all the buildings. Any spot in the buildings of the main works can be reached with a 1½- or 2½-in. hose line from one or more of the numerous standpipes. This works also has a hose cart carrying 500 feet of 2½-in. hose.

In addition to fire extinguishers the Orchard Works has a hose cart with 750 feet of 1½ in. hose and a 40-gal. soda acid extinguisher on wheels.

Finally, all members of the fire brigade have been thoroughly trained to recognize fire hazards, which they must report at once to the maintenance department, and in salvage work. Both these activities are considered to be highly important.

Among many other well-organized and well-equipped industrial fire brigades in Milwaukee the one serving the Pabst Brewing Company may be mentioned briefly. This brigade has a long history of valiant service, both to the brewery and to the city. For example, a private city firebox was for years located at the headquarters of this brigade. When the city fire department was called out, the alarm was registered at this box, and the company firemen stood ready. Three men were kept on the job through the night. Whenever there was a large fire in the city the chief of the brigade and his six men stood ready to assist the city department in any way that might be needed. On many occasions when the city department was fully occupied with a big fire, the Pabst brigade has turned out and extinguished fires in its neighborhood.

Trained 22 Men

When prohibition came in, this brigade was disbanded. Several years ago it was reorganized under the leadership of Edward K. Crosby, fire marshal and chairman of the Pabst Defense Council. The chief, Herman Grade, has held that post for 40 years.

After the attack on Pearl Harbor, arrangements were made with the Milwaukee Fire Department for the 22 members of the brigade to take the training course for industrial firefighters. These men attended the school for a period of 16 weeks, sometimes in weather 18 degrees below zero. When graduated they received diplomas, arm bands, and identification cards from OCD and the Milwaukee Fire Department. From the Pabst Company they received official badges which must be worn at all times.

The plant is divided into four fire zones, each with an assistant chief in charge of the firefighters. There are 47 buildings in the plant. Each platoon, consisting of ten men, is composed of a welder, millwright, steelworker, electrician, carpenter, steamfitter, and laborers. All are trained firefighters. The fire marshal and the brigade chief, Les Kyler, maintenance superintendent, answer all calls and supervise the work of the brigade.

IF YOUR COPY OF *FACTORY* IS LATE—

Be patient, please. The nation's transportation system is severely loaded. The delay may be unavoidable. Allow a few extra days before writing us. Both the publisher and Uncle Sam are doing everything they can to get your *Factory* to you on time

Three Ways to Lay Out a Personnel Department

CYRIL T. TUCKER, Office of the Plant Engineer, Hawk-Eye Works, Eastman Kodak Company, Rochester, N. Y.

CAREFUL ORGANIZATION of the personnel department is necessary because of the growing complexity of labor records, and the increasing social-mindedness of modern governmental administration. Hence it is a far cry from an earlier small factory, where the "boss does the hiring" to a modern personnel department.

Each plant has its own layout problem, and personnel departments will vary all the way from the one shown in Figure 1, which might be suitable for a small plant, to the separate building needed by a big airplane company. Figure 2 shows the personnel department of a plant where it has been possible to place a completely equipped medical department adjoining the employment center and have it accessible for applicant examination as well as serving the entire plant. The plant has an employee personnel of 10,000 to 14,000.

There are, however, principles that are common to all. Personnel functions can be roughly divided into three main divisions, although each plant will have its own grouping:

Employment—recruiting; applicants; identification; examinations; aptitude tests; induction.

Industrial Relations—schooling; records; statistics; insurance; pensions; disputes; advancement; job evaluation; discharge.

Employee Services—medical; cafeteria; clubs; associations; legal aid.

As a rule, plant security is delegated to another department, and the only connection that the personnel department has with it is in original identification, providing the new employee with identification cards or badges, taking fingerprints, and protecting the plant against intrusion through the applicant channel.

Obviously, all the functions of the personnel department should be at or near the main employee entrance, except the cafeteria, which is more likely to be centrally located. Because space near the entrance is at a premium, it may be found desirable to locate some functions elsewhere, but this has to be weighed against the disadvantages of having the department split up. For instance, the medical department might be located near the center of the plant for easy access. In this case, an examination room can be provided in the employment section, otherwise it becomes necessary to provide temporary badges and to escort groups through the plant for medical examination.

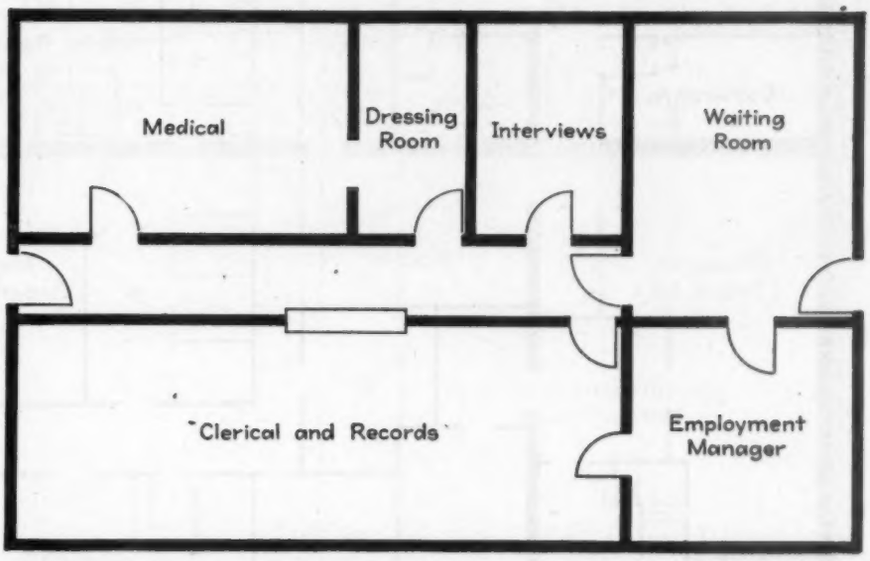


Figure 1. Little need for an elaborate personnel department in the small plant, where it is likely that "the boss does the hiring"

The Clubroom Problem

Clubrooms present a problem if the plant security program prohibits the entrance of an employee except at the time of his appointed shift, because club activities are nearly always during the off-shift hours. Many plants have abandoned much club activity during the war period unless the clubrooms have an access directly from the street and can be closed off from the plant itself.

In one instance the space available for the personnel department was on both sides of one of the main employee entrances. This meant that it was necessary to separate it into two fairly independent units, because traffic across the entrance had to be kept at a minimum. This was done by putting the employment section, with its relatively large amount of floor space, on one side, and industrial relations and employee services on the other. The medical department was already established in a central section of the plant, therefore it was found advisable to group the applicants and send them for examination under the care of a messenger guide. This was the only break in the security net, as the badges were not given to the applicant until he had passed the physical tests.

The existing entrance was divided. One section was reserved for employees entering through the turnstiles at the guardhouse, the other gave free entrance to the applicant directly into the employment waiting room. At this point control was maintained by stationing a guard with electrical control over the exits from the waiting room into the plant. The guard functioned as an information center, and also controlled the possibility of regular employees using the applicants' entrance as an exit with forbidden packages. This layout is shown in Figure 3.

For regular employees, access to the

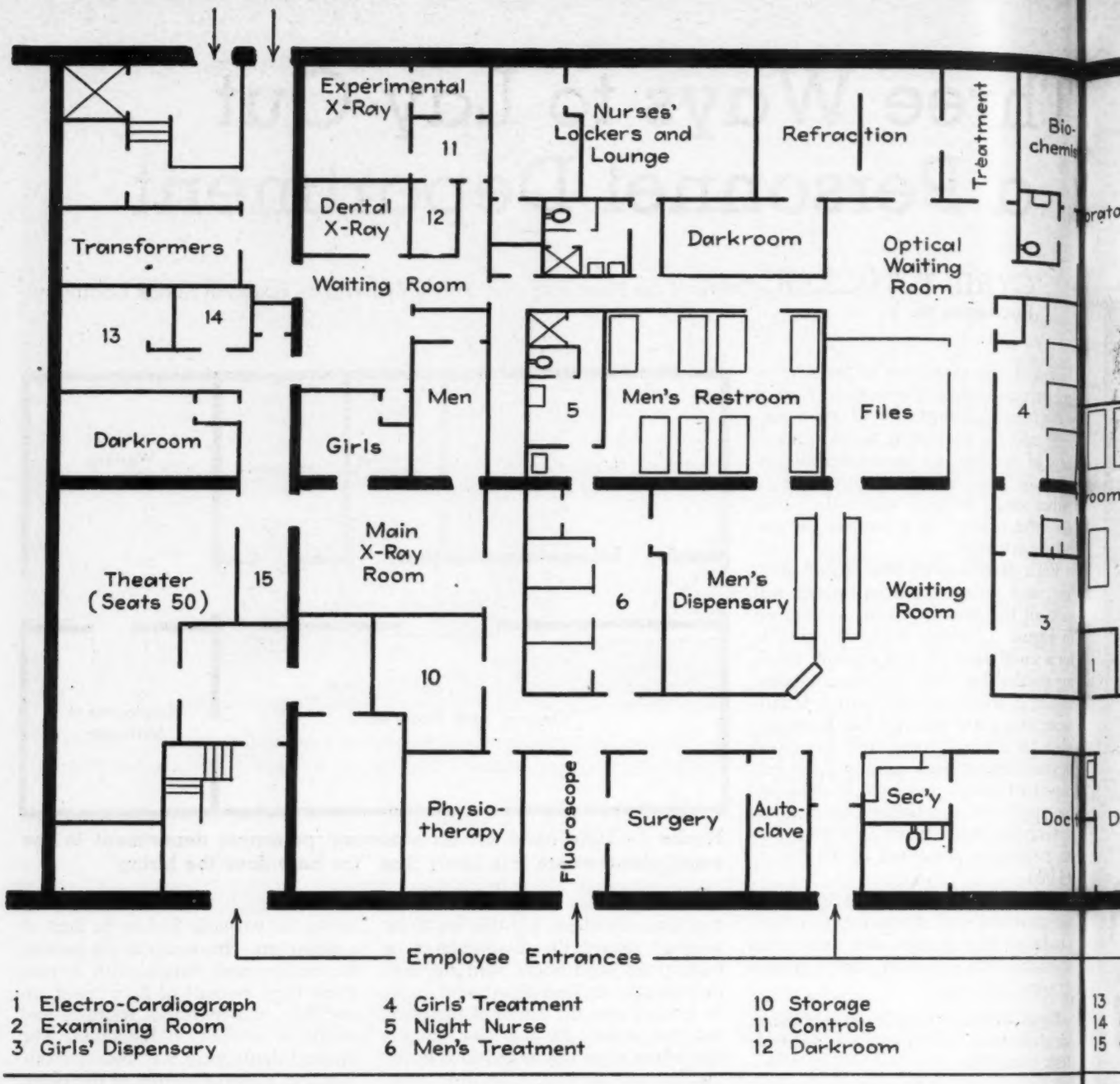


Figure 2. Nothing that the personnel department can contribute to employee health, happiness, and comfort is omitted in this layout for a large plant

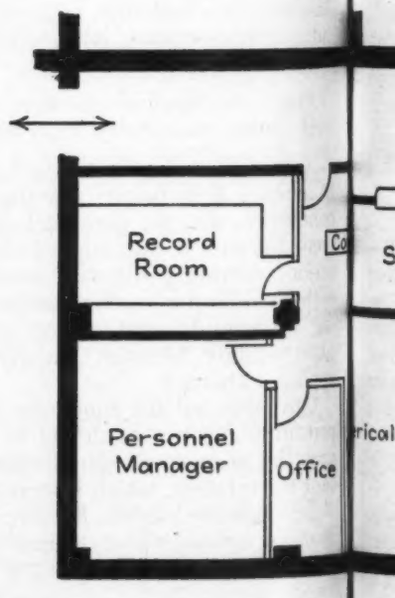
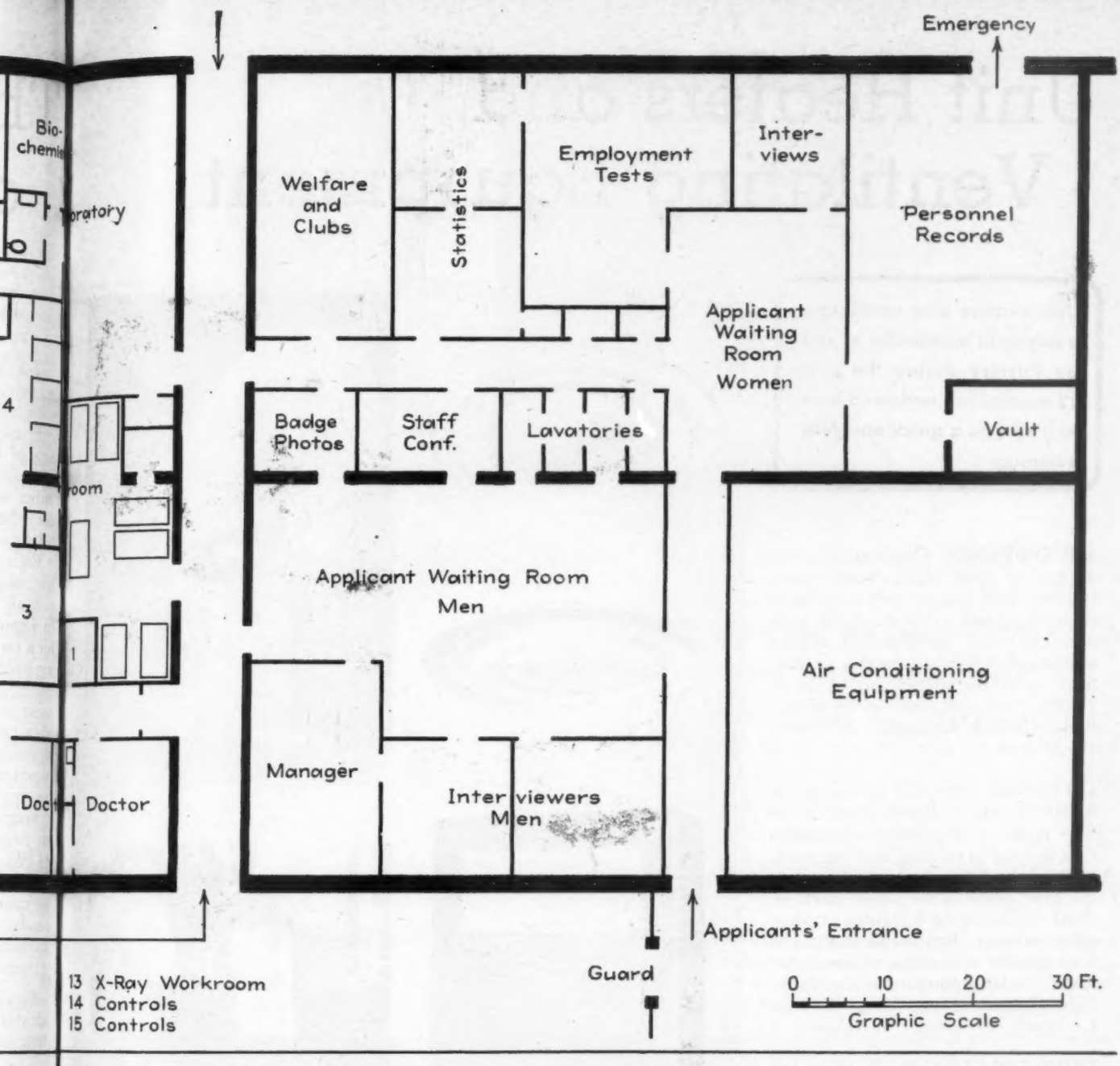


Figure 3. In this medium-sized plant, the personnel department is split into two halves—one for the regular employees, the other for applicants

personnel section is provided by a counter off one of the main corridors of the plant. The record room is placed close to this counter so that when an employee stops to ask a question, the file containing all his papers is obtained, and the question is answered. This record room contains a fireproof safe or a vault for keeping bonds, war savings stamps, club finances, and miscellaneous cash or valuable records. If a consultation is necessary, the employee is allowed past the counter to one of the two offices, where his problem is taken care of.

With all the current and difficult problems of gas and tire rationing and Selective Service questions, some method of streamlining this service must be provided. The personnel handled by the department illustrated is approximately 6000.


Emergency
Welfare and Clubs
Statistics
Employment Tests
Inter-views
Personnel Records
Applicant Waiting Room Women
Badge Photos
Staff Conf.
Lavatories
Vault
Applicant Waiting Room Men
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Doctor
Applicants' Entrance
Guard
13 X-Ray Workroom
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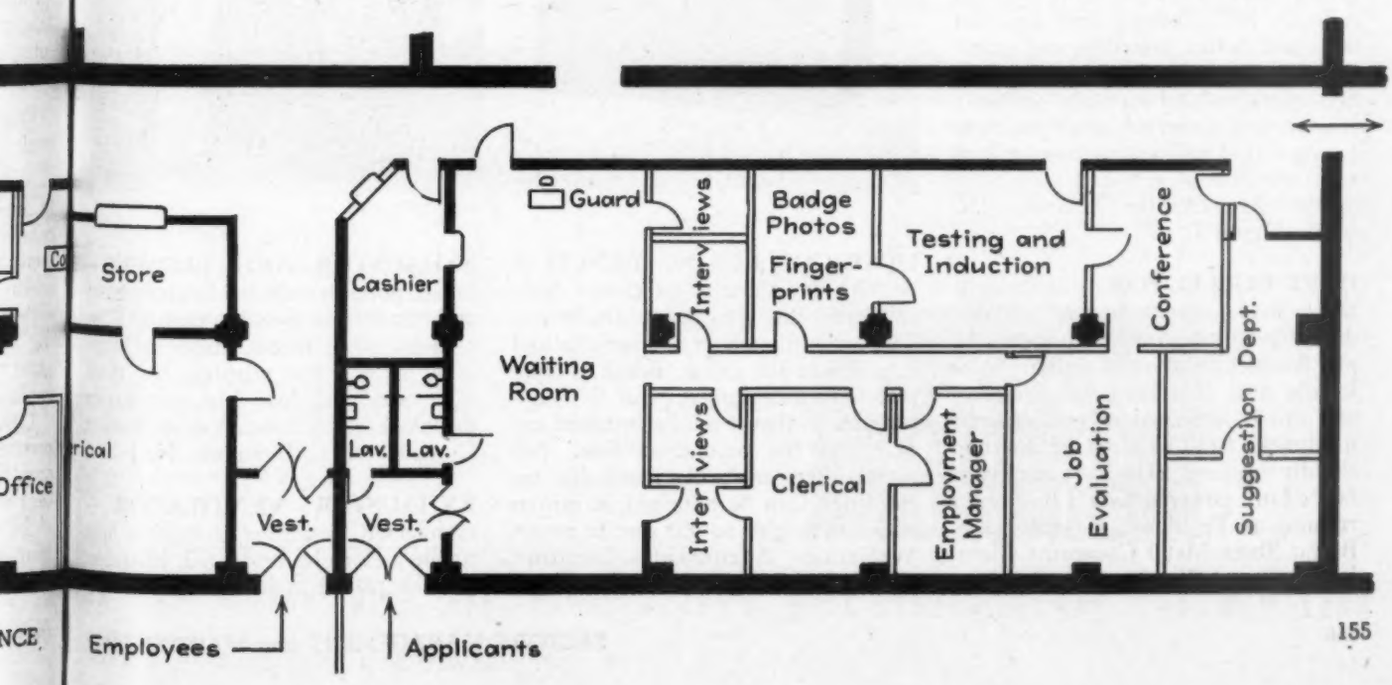
Graphic Scale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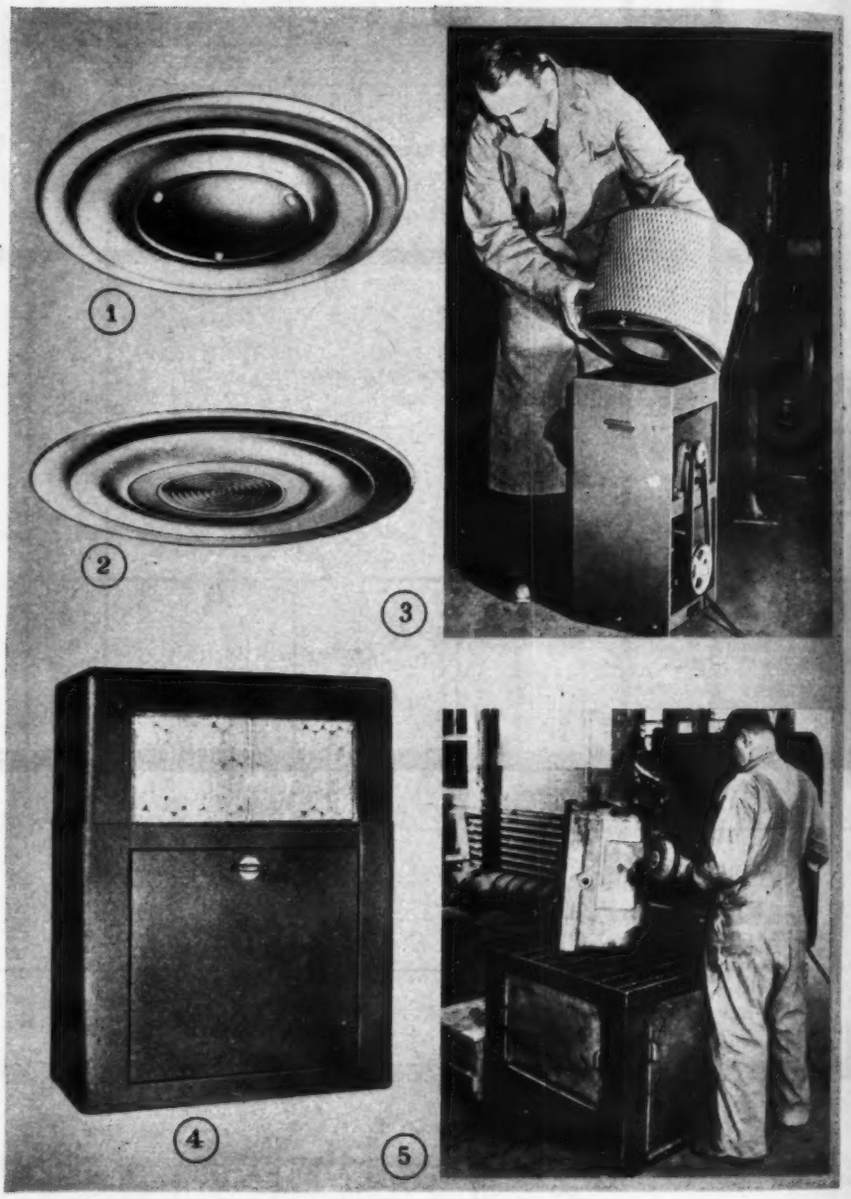
Interviews
Clerical
Employment Manager
Job Evaluation
Suggestion Dept.
Employees
Applicants

Unit Heaters and Ventilating Equipment

Unit heaters and ventilating equipment introduced to you by *Factory* during the past 12 months are reviewed here to give you a quick one-year summary



AIR DIFFUSER—Overhead type air diffuser of spun steel. Relationship between neck area of unit and throat is proportioned to create slight back pressure, which automatically insures uniform distribution around periphery. Sizes to handle volumes of air up to 15,000 c.f.m. per unit are available. Barber-Colman Company, Rockford, Ill. (Figure 1)

DIFFUSER—Designed for use in installations where simplification of the duct layout is of primary importance. Can be used in existing building work, because the return duct may be run to the same point as the supply duct, instead of leading to a register at some other location. Removable center section consists of a series of concentric rings. Gasket around outer edge forms tight seal with ceiling. Barber-Colman Company, Rockford, Ill. (Figure 2)

DUST COLLECTOR—Portable dust collector for collecting dust and dirt from tool cutter, precision, and grinding operations. Has a rated volume of 600 c.f.m. and 4.1-in. static pressure. Unit is self-contained; multiple-blade fan on end of ball-bearing countershaft is driven through a V-belt by a ½-hp. motor. Aget-Detroit Company, Detroit. (Figure 3)

DUST COLLECTOR – Lightweight sheet steel cabinet houses portable dust collector designed to provide simple, flexible dust control system. Will handle dust from two 9-in. grinders and can be attached to two separate machines. Returns clean air to shop slightly warmed. Has a capacity of 600 c.f.m.; powered by a ½-hp. motor running an Ilg blower at 3400 r.p.m. Bargar Sheet Metal Company, Cleveland. (Figure 4)

DUST COLLECTING BENCH—A positive downflow of air carries dusts away from the operator into the bench. The air is filtered of all particles and returned to the room. Bench is completely self-contained, and is semi-portable so that it can be installed any place on the production line. All-metal filters are easily removable for cleaning. Can be obtained in various sizes and heights to suit specific needs. Wolverine Equipment Company, Cambridge, Mass. (Figure 5)

EXHAUSTER AND BLOWER—Small, portable unit to eliminate gases and fumes from closed-in places. Powered by ¾-hp. motor, sucks or blows 2000 c.f.m. Has adapters for three 4-in. nozzles or four 3-in. nozzles for flexible hose. Chelsea Fan & Blower Company, Inc., Irvington, N. J.

EXHAUSTER - VENTILATOR – Connected by means of flexible hose to the area to be ventilated, exhauster may be placed or hung anywhere be-

Exide Ironclad ease of handling means increased dependability

Complex equipment is all right in its place, but today, Industry has a big job on its hands. Tools which are simple and easy to handle, save time, money, and materials. That's why Exide Ironclad Batteries, long known for their durability and dependability, are playing such an important part in the industrial war of movement. They shorten the training periods of new workers. They save materials through their long life . . . and most of all they do a big job and do it well!

ANY WORKER CAN FOLLOW THESE EASY MAINTENANCE STEPS . . .

Keep adding approved water at regular intervals. Most local water is safe. Ask us if yours is safe.

Keep the top of the battery and battery container clean and dry at all times. This will assure maximum protection of the inner parts.

Keep the battery fully charged—but avoid excessive over-charge. A storage battery will last longer when charged at its proper voltage.

Record water additions, voltage, and gravity readings. Don't trust your memory. Write down a complete record of your battery's life history. Compare readings.

If you wish more detailed information, or have a special battery problem, don't hesitate to write to Exide. We want you to get the long life built into every Exide Battery. Ask for booklet Form 1982.

1 **High Power, More Production:** To get the most from any battery-powered electric vehicle, its battery must deliver good voltage, hold that voltage high, and be ready for emergency demands with a giant surge when needed. Exide Ironclads do just that.

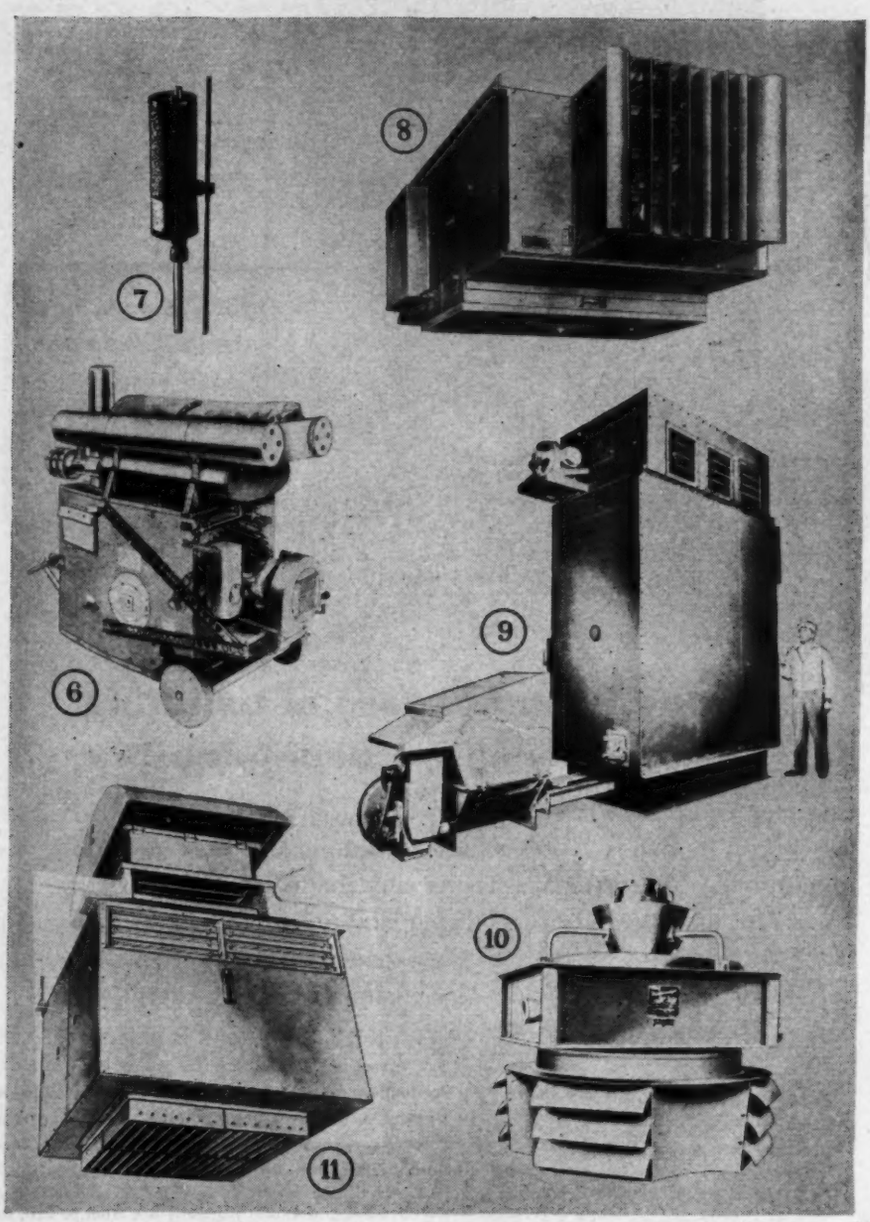
2 **Long Life, Saves Materials:** Rugged Exide Ironclads are built to last, and save vital materials by getting maximum use from everything that goes into their making. When you buy an Exide you definitely—Buy to Last and Save to Win!

3 **Easy Maintenance Saves Labor:** Exide Ironclads are kept charged by the simplest method ever devised. With the Exide Charge Control Unit there's nothing to do but connect the battery to the charging source and turn a knob . . . a job the greenest worker can handle.

THE ELECTRIC STORAGE BATTERY CO., Philadelphia
Exide Batteries of Canada, Limited, Toronto

ARMY E NAVY

Exide
IRONCLAD
BATTERIES



tween the working area and the open air. Powered by a heavy-duty ball-bearing motor equipped with overload protection. Can be converted into fresh-air ventilator by changing the position of the tube adaptor. One to six nozzles can be used. Caps are provided for all nozzles not in use. Chelsea Fan & Blower Company, Irvington, N. J.

HEAT CIRCULATOR—Air is blown upward, which forces it to travel along the ceiling, down the sides and up the center again, putting all the air in the room in gentle motion, without drafts. Circulators are available with 20- and 24-in. propellers. They have three speeds, and use 110-volt, 60-cycle a.c. Reynolds Electric Company, Chicago.

HEATER — Self-contained, self-powered heater is portable source to be used wherever auxiliary or temporary heat is required. Direct fired, can be obtained in models that use gasoline for engine and heater fuel or in models that use gasoline for engine fuel and No. 2 fuel oil for heater fuel. Small gasoline engine drives pressure-type propeller fan which blows air over the combustion chamber and out through two openings, and also drives small centrifugal fan to provide air for combustion. Various systems of collapsible canvas ductwork are used to convey the heated air to the desired location. Unit is equipped with two retractable wheels. Heating capacity is 250,000 B.t.u. per hour at 60-deg. inlet. Herman Nelson Corporation, Moline, Ill. (Figure 6)

HUMIDIFIER—For use on steam-heating systems which carry less than 20-lb. pressure. Installed on the feed end of radiators or on steam risers at points where the condensate will return to the boiler when radiators are turned off. Compact unit, entirely automatic in operation, diffuses moisture into the air. Techtmann Industries, Inc., Milwaukee. (Figure 7)

HUMIDIFIER — Provides automatically controlled air cooling by evaporation. Connection to outdoors provides ventilation. Suitable for plants of any size, because either single or multiple installation is possible. Requires no floor space; easily installed and moved with no interruption to production. All parts easily accessible. Drip pan on ball-bearing rollers moves on a track, permitting access to the interior of the unit. Carrier Corporation, Syracuse. (Figure 8)

UNIT HEATER—In either horizontal and vertical delivery types. Ingot iron condenser tubes and headers. Tubes have wall thickness of 0.065 inch. Steel fins are permanently bonded with metal to the iron tubes, to seal contact of fin to tube from corrosion. Modine Manufacturing Company, Racine, Wis.

UNIT HEATER—Direct-fired coal-burning unit equipped with underfeed stoker of either bituminous or anthracite type is available also for hand firing. Eight sizes, from 750,000 to 4,000,000 B.t.u. Is self-contained, having its own combustion chamber and distributing warm air either directly from outlet vents or through a simple duct system. Unit may be installed during construction and used for temporary heat, or retained as a permanent system. Dravo Corporation, Pittsburgh. (Figure 9)

UNIT HEATER—Revolving, allows the adjusting of the amount of heated air discharged from any side of the unit, thus making it possible to heat a long, narrow room or building with one unit. Discharge from multiple outlets is effective in buildings or rooms with low ceilings. L. J. Wing Manufacturing Company, New York. (Figure 10)

UNIT HEATER AND VENTILATOR—Has dampers that control the ratio of fresh to recirculated air. Control range is 100 percent fresh air to 100 percent recirculated. Heating coils will temper full capacity of outside air from 20 degrees below zero. Rigid angle iron frame is used with either steel or non-metallic housing. Two types of diffuser outlets are available. Young Radiator Company, Racine, Wis. (Figure 11)

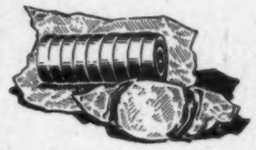
When Installing Bearings

IT PAYS TO BE A "YES-MAN"

These hints will help you get maximum performance from all types and makes of bearings. They are highlights from Hyatt's Bearing Maintenance Handbook, and are published here as a wartime service.

Yes

Keep bearings clean... away from dust, dirt and moisture. Leave them in original wrappings until ready for use. (Hyatt Roller Bearings are protected against rust and corrosion by a special lubricant)

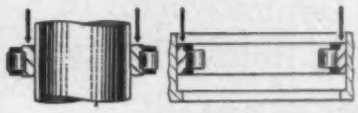


No

Do not handle bearings unnecessarily; avoid touching roller operating surfaces, as moisture from the hands may cause rust. Be sure that hands, tools and surroundings are clean at all times.

Yes

When bearings or bearing parts are assembled on a shaft, apply pressure to end of inner ring or race; when in a housing, apply pressure to end of outer race. Lubricate all shaft and housing surfaces which are in contact.



No

Never apply pressure to roller cages, ball retainers, seals or end rings. Don't "cock" the race ... damage to both shaft and bearing will result. Always apply pressure to the race ends straight and square.

Yes

Assemble bearing on shaft and into housing carefully to avoid scoring races and rollers. Lubricate thoroughly and regularly according to manufacturers' specifications, using fresh, clean lubricant.

No

Never, never, NEVER strike any part of any bearing with a hammer. Use an arbor press, hammer-and-drift, or bearing driver instead. Avoid using wooden or soft metal mallet, as chips may get into the bearings.

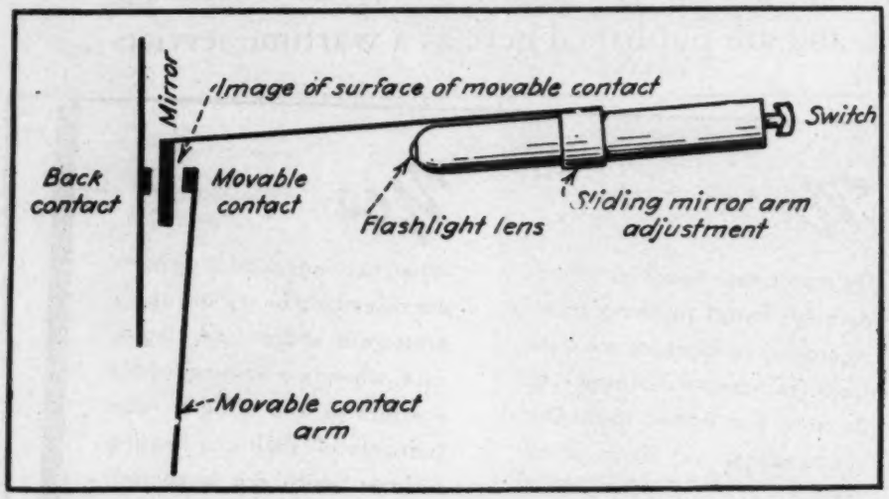
READY SOON: The Hyatt Roller Bearing Maintenance Handbook is now on the press. Would a copy help you? If so, write on company letterhead to Department 204, Hyatt, Harrison, New Jersey. We'll be glad to send you a copy with our compliments.

HYATT ROLLER BEARINGS

HYATT BEARINGS DIVISION · GENERAL MOTORS CORPORATION · HARRISON, N. J.

MAINTENANCE SHORTS

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary maintenance accomplishments. Accepted articles will be paid for



Uses Dental Mirror to Inspect Relay Contacts

H. G. PACK, San Mateo, Calif.

Electrical equipment has numerous relays and magnetic contactors that require routine inspection of their silver contacts. A dental mirror and flashlight combination is most useful. The mirror is inserted between the contacts and the light turned on. Thus the invisible surface of the front contact is exposed to examination without removing the arm upon which it is mounted. The stationary contact is usually visible.

•

Welded Railing for Better Looks, Service

FRANK KOHANOWSKI, St. Joseph Lead Company, Monaca, Pa.

Welded railing has many advantages over railing put up with fittings.

Fittings become loose, whereas welded railing will stay rigid and will stand more shock.

Welded rail stands up longer in the weather, because threads rust away.

Welded rail has no projections, and the top rail is smooth and continuous.

The pipe, being bent at all corners, bottoms of stairways, and ends of railings, adds to the safety and appearance of the railing.

Welded railing that has to be removable for machine repairs or the like will stand for the life of the pipe. Rail placed with fittings will become shaky and require maintenance.

With welded railing joints can often be made that would be impossible with fittings to give a smooth and continuous top railing.

This study won an award in the recent Industrial Progress Award Program, James F. Lincoln Arc Welding Foundation.

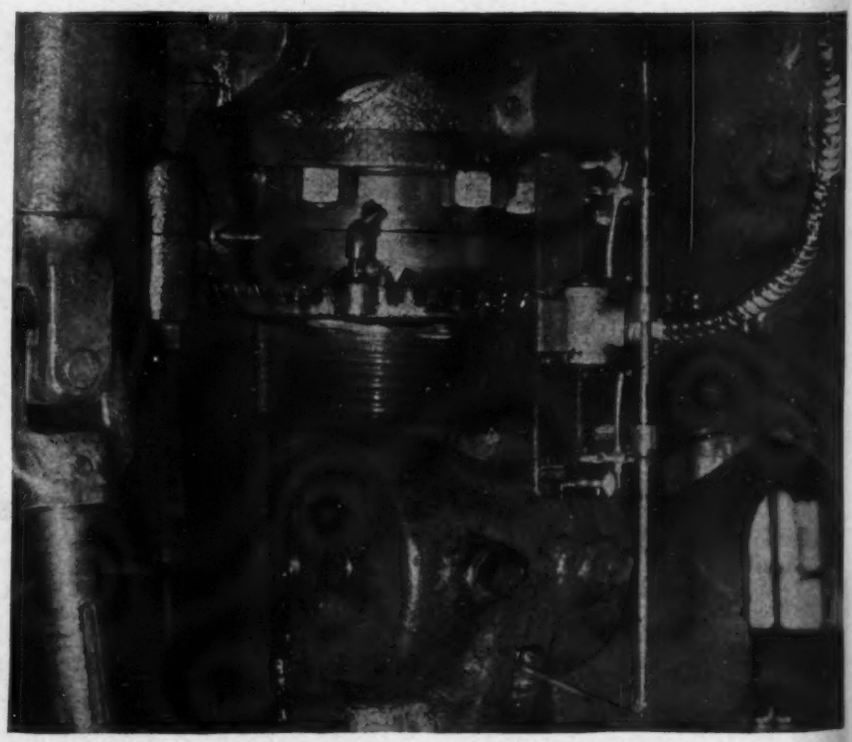
Walkway Supports Protect Mastic Floor

JOHN J. NASH, Chief Engineer, American Fixture & Manufacturing Co., St. Louis

Transferring the weight of the walkways between plating tanks from the floor to the tanks has made a saving of about $4100 a year, and eliminated a troublesome condition that cost about two weeks' downtime every year.

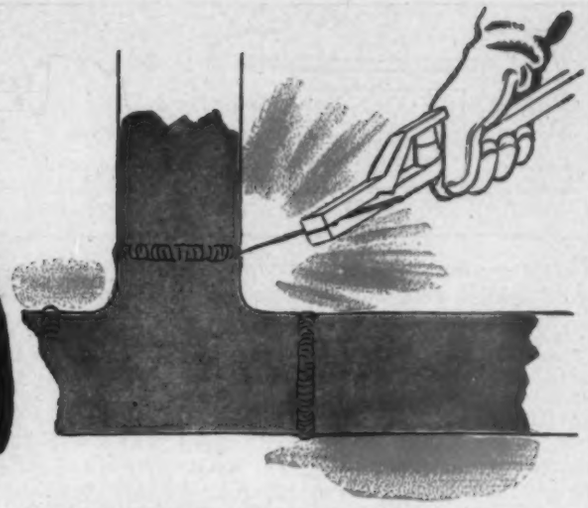
Our plating tanks are 48 to 50 inches deep. Hence it is necessary to provide elevated walkways or work decks between them for efficient operation.

Formerly these walkways, made in 4x6-ft. sections of parallel 2x4-in. yellow pine boards, were supported by 2x4-in. legs resting on the mastic floor, as shown in Figure 1. These sections, placed side by side, provided a flooring with openings that permitted drippings to fall through to the true floor beneath. This arrangement was satisfactory for the operators, but it caused an excessive amount of trouble because: (1) Weight of the walk-



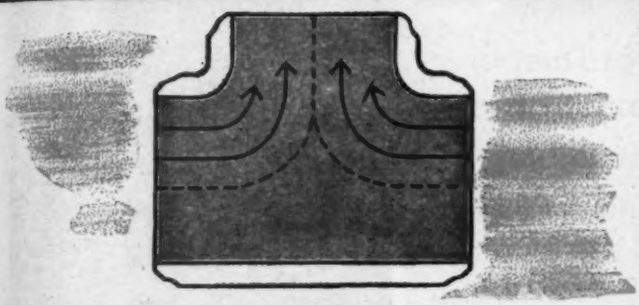
To prevent jamming or running pitman screws out too far on a large punch press, Westinghouse Electric & Manufacturing Company's Mansfield, Ohio, plant uses limit switches. Connected in the electrical circuit of the adjusting motor, they operate by stops mounted on a rod fastened to connector pitman. Switches are used when changing ram adjustment to suit various dies

How TUBE-TURN welding tees improve piping construction



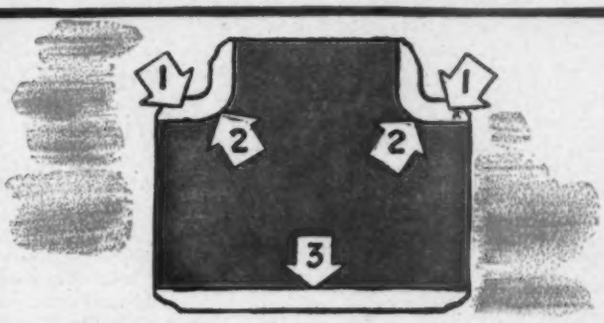
LONGER OUTLETS SPEED WELDING

More room for easier manipulation of rod means faster welding and better, sounder welds.



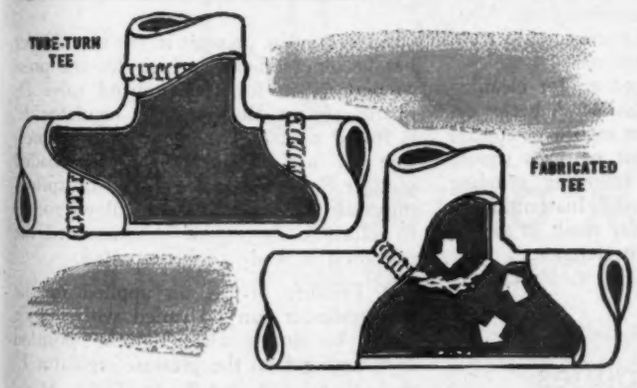
SMOOTH FLOW, LESS PRESSURE LOSS

Smooth inner walls assure even flow and reduce wear. Rounded inside crotch reduces pressure loss.



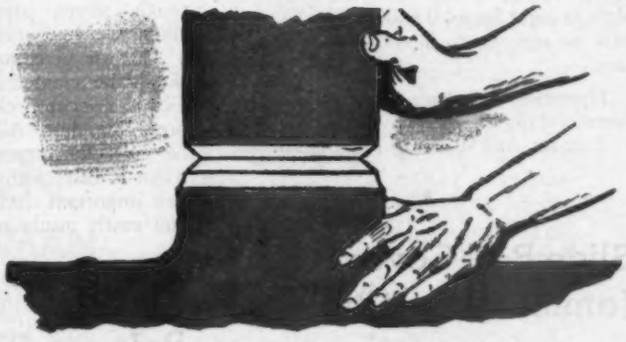
EXTRA STRENGTH AT STRAIN POINTS

Added thickness at top of run (1), crotch (2) and bottom (3) strengthens points of highest stress.



NO FABRICATION FAULTS

Fabricated tees often have jagged corners, crude welds, and slag. Tube-Turn Tees eliminate these.



FASTER, EASIER ALIGNING

Accurate bevels, plus I.D. and O.D. that exactly match the pipe, make aligning simple and speedy.

TUBE-TURN
TRADE MARK

TUBE TURNS (Inc.) Louisville, Ky. Branch offices: New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Dayton, Washington, D. C., Houston, Los Angeles. *Distributors in principal cities.*

NO. 8 OF A SERIES
HOW TUBE-TURN WELDING FITTINGS BENEFIT WAR INDUSTRY
The FIRST WELDING FITTINGS 1ST

Welding Fittings and Flanges

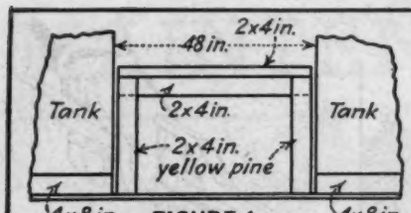


FIGURE 1

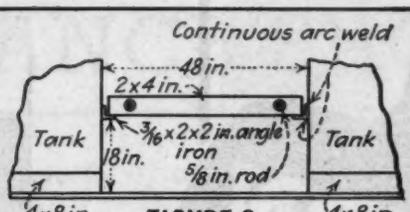


FIGURE 2

Figure 1. Supports for walkways formerly rested on the mastic flooring, and damaged it seriously. Figure 2. Walkways are now supported on angles welded to the sides of the tanks

ways caused the supporting legs to put dents and holes in the mastic flooring; (2) chemicals draining into these indentations seeped through the floor and dripped on merchandise stored below; (3) weekly rinsing and repair operations required the services of a six-man crew and stoppage of plating operations one day a week; (4) the deck supports had to be replaced periodically; (5) once a year it was necessary to shut down operations and replace the patched and worn mastic floor surface, which was a costly procedure.

After completing a yearly reflooring job some time ago, we decided to eliminate the need for supporting the walkways through legs resting on the mastic floor. Since the work was completed there have been no leaks in the flooring surface. From all appearances, the life of the floor can be estimated, conservatively, at three years.

All the tanks (they are made of steel) were placed on 4x8-in. timbers. Then we arc-welded 2x2x$\frac{3}{16}$-in. structural angles to the sides, 18 inches above floor level, as shown in Figure 2. These angles were used to support the walkways. We reduced the sections from 6 to 4 feet and tied the 2x4-in. pieces and spacers together with $\frac{5}{8}$-in. steel rods. This change made them easier to remove. Now four men can complete in eight hours the job which formerly took six men to do in the same length of time.

This study won award in the recent Industrial Progress Award Program, James F. Lincoln Arc Welding Foundation.

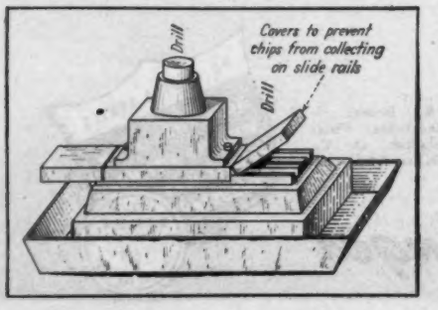
•

Slide Rail Cover Stops Jamming by Chips

This suggestion won an award from the War Production Board.

When slide rails on which a fixture was moved back and forth by hand collected chips, which happened frequently, fixture was stuck or the machine was jammed. It was then necessary to pry the chips out of the rails, a procedure that sometimes resulted in throwing the fixture off location and always delayed the operation. Sketch illustrates a cover which, attached to the fixture, keeps out the chips.

Suggested by John R. Rye, Wright Aeronautical Corporation, Cincinnati.



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Watch Out for Dust in Grinding Commutators

FRANK V. FAULHABER, Brooklyn

In grinding the commutator on a motor, copper dust and other waste particles sifting into the windings of armatures, field coils, and other vital parts can do serious damage.

Protective coverings should be provided. Circular shields of cardboard or fiber may be attached securely to the frame for protection, or a cloth or canvas hood wound tightly round the necks of the commutator and the front-end windings. Even tough, strong paper fastened or pasted about the equipment will serve.

The use of compressed air for cleaning should be avoided if possible. A better device is a vacuum cleaner set up to control prevailing dust. All dust particles should be carefully removed following grinding when a dust cloth is used. Inattention to this important detail may result in serious and costly insulation interference.

•

Release Simplifies Press Operation

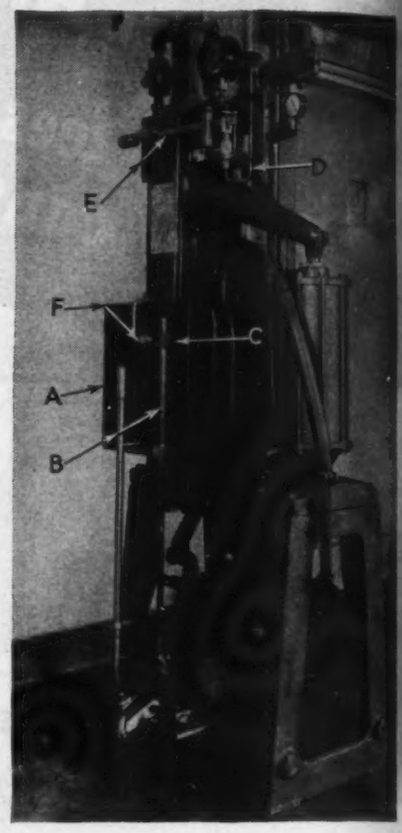
This suggestion won an award from the War Production Board.

Hand lever and automatic releasing device attached to an air press eliminates the necessity for the operator's applying pressure to the foot pedal of the press, holding the pedal, and watching the gage until the desired pressure is reached in the air cylinder of the press.

The operation of the press, with the new device attached, is simply to pull the hand lever forward about 6 inches and release it. When the required pressure is reached in the air cylinder, the press automatically shuts off. In the meantime, the operator has sufficient time to prepare another piece to insert into the press.

The action of this device is as follows:

1. Pulling lever A opens air valve from the line, allowing air to enter the press cylinder. At the same time, rod B is pulled downward and locked by a spring-loaded knife edge at C, holding the valve from the air line open.



2. When the pressure in the air cylinder has become sufficiently high for the press to perform its function, control valve D, acting against the pressure regulator E, is forced open. This allows the air pressure to act against the spring-loaded plunger F, which releases rod B by springing knife edge at C. This allows rod B to return to its original position, and the operation is ready to be repeated.

3. Pressure of the air applied to the press cylinder can be varied within wide limits by simply changing the position of the weight on the pressure regulator E.

Suggested by Daniel T. Caulfield, Naval Torpedo Station, Newport, R. I.

•

As a safety measure one plant has provided electric trucks with foot guards. The guard completely encircles the two pedals used for operating the truck brakes. The operator must stand well within the guard with both feet on the pedals to operate the truck. In tight quarters the guard protects him from possible injury.

Trade Marks "ScotTissue," "Soft-Tuff," "Washroom Advisory Service" Reg. U. S. Pat. Off.

THE MISSING MAN

is today often the MISSING WOMAN

WOMEN are doing men's jobs on many war-production lines today—but illness continues to cause an average loss to industry of a week's production time in a year. At least half this serious loss is due to minor contagions—such as colds and their complications.

Clean, sanitary washrooms greatly help to check the spread of contagion . . . Soap, hot water and individual tissue towels encourage men and women to wash up thoroughly and often—and washing chases germs.

Also, when you make "health zones" of your washrooms, you help build good will with your employees—and good will, too, means less absence from work.

The Scott Washroom Advisory Service can help you make your washrooms "Health Zones"

On request, a thorough survey of your washrooms will be made by the Scott Washroom Advisory Service. It may suggest many improvements to help cut down the number of "Missing Men" in your plant.

If you provide ScotTissue Towels, it will point out ways to prevent their waste, so that other companies can share the supply. For example, our educational material reminds employees that *one* ScotTissue Towel dries completely.

Actually, a "Soft-Tuff" ScotTissue Towel can absorb twice the water left on hands. And it has ten times the rub strength of previous ScotTissue Towels, though soft as ever.

Also available: numerous proven aids for establishing a sound industrial health program. Ask for our *Health Is Ammunition, Too* booklet and posters.

Scott Paper Co., Chester, Pa.

SCOTTISSUE TOWELS

STAY TOUGH WHEN WET

Painting Building Surfaces

Adequate protection of building surfaces against the weather and other destructive influences depends on proper preparation of the surface, and careful application of a suitable protective material.

Wartime conditions have made necessary some changes in the composition of paints and other protective media. Intensive research has also brought about changes and improvements in these materials. Therefore it is advisable to seek the recommendations of paint manufacturers regarding specific applications, in order that full advantage may be taken of the latest developments.

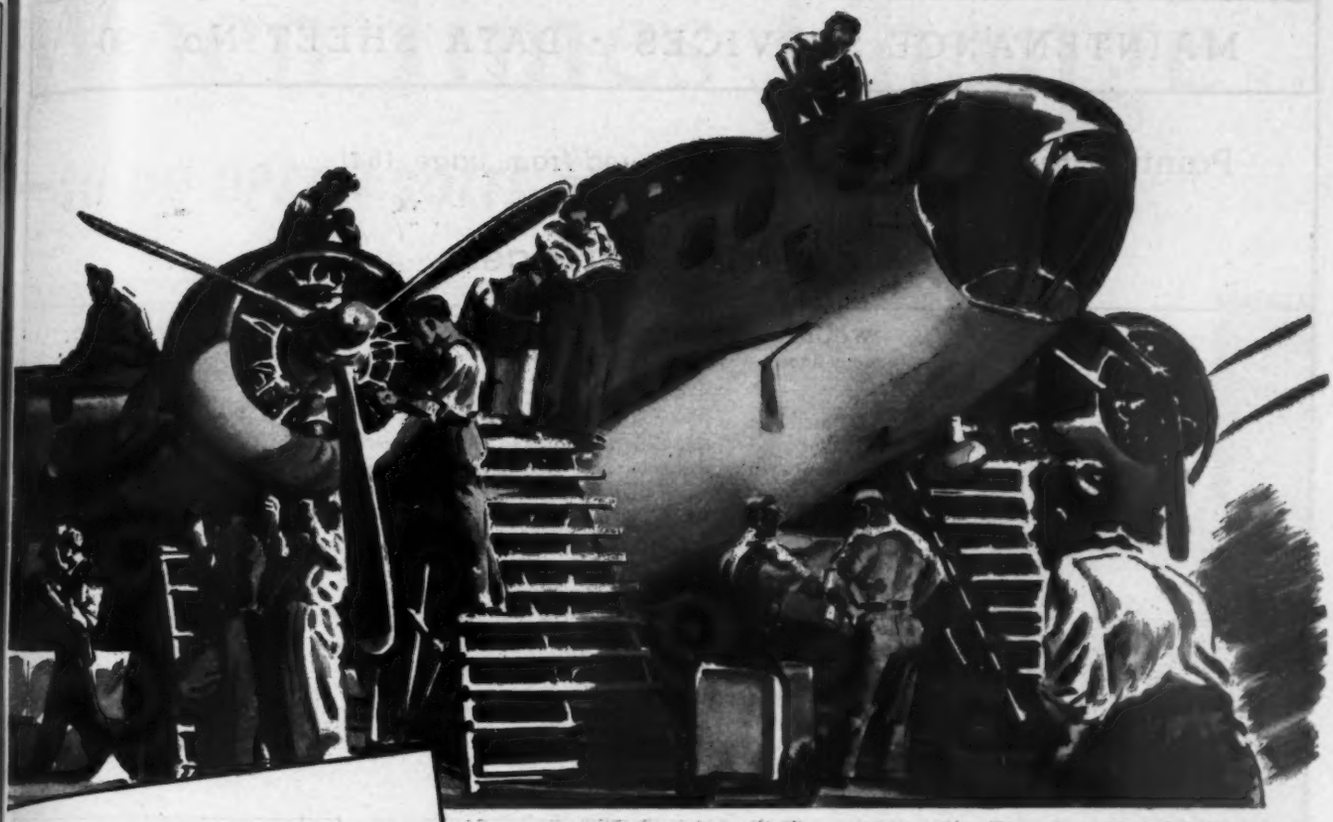
In the accompanying tables are given the fundamental steps that must be followed when painting plant buildings and yard equipment.

Interior Surfaces

		STEEL	WOOD	CONCRETE	BRICK	PLASTER
PREPARATION OF SURFACE	NEW	Remove dirt. Clean off oil, grease, with suitable solvent. Sandblast if possible; otherwise wire brush thoroughly	Brush off dirt, loose particles. Apply shellac or other sealer to knots and resinous spots	Brush off dirt, loose particles. Paint cracks and holes	Remove dirt, grease, loose particles. Point cracks with rich mortar mix	Brush off dirt, loose particles. Point cracks, fill holes with cement mortar
	OLD	Sandblast, wire brush, or chip thoroughly to remove rust, loose scale, and old paint	Brush clean. Remove old paint if badly cracked or chipped	Brush clean. Scrape off loose paint. Cover oil spots with shellac or masonry primer	Brush clean. Scrape off loose paint. Remove oil or grease. Point cracks with rich mortar mix	Brush clean. Scrape off loose paint. Fill holes, cracks with cement mortar, and give thin coat of clear varnish or shellac size
PRIME COAT	NEW	Apply well-brushed coat of effective rust-inhibiting paint. Thin paint as directed	Apply coat of enamel undercoater	Apply coat of interior masonry primer recommended by paint manufacturer	Apply coat of interior masonry primer recommended by paint manufacturer	Apply coat of plaster primer
	OLD	If steel is exposed, prime with rust-inhibitive paint as on new surface	If needed, same as for new surface	If needed, same as for new surface	If needed, same as for new surface	Apply plaster primer if finish coat is eggshell or gloss
SECOND COAT	NEW	For two-coat job, apply linseed oil paint, alkyd synthetic enamel, or metal protective paint recommended by paint manufacturer. If three-coat job, apply intermediate coat recommended by paint manufacturer	Usually not needed	Usually not needed	Pigmented flat paint, to cover surface discoloration, and prepare base for final coat	Usually not needed
	OLD	Same as for new surface	Usually not needed	Usually not needed	Same as for new surface	Usually not needed
FINISH COAT	NEW	Apply linseed oil paint, alkyd synthetic enamel, or metal protective paint recommended by paint manufacturer	Apply interior gloss paint, or enamel	Apply interior flat, eggshell or gloss paint, or enamel	Apply interior flat, eggshell, or gloss paint, or enamel	Apply interior flat, eggshell, or gloss paint, or enamel
	OLD	Same as for new surface	Same as for new surface	Same as for new surface	Same as for new surface	Same as for new surface

(Continued on page 166)

Data Supplied by New York Paint, Varnish, and Lacquer Association



NON-CONDUCTING MATERIALS HEATED FAST WITH THERMEX

Take airplane parts for example:

PLASTICS: Control knobs and handles. Radio parts. Instrument panels. Engine parts.

PLYWOOD: Propellers. Spars. Ribs. Skins. Crew seats.

RUBBER: Such as miscellaneous molded mountings for parts that must ride in rubber.

INSULATING MATERIALS: Fuselage. Radio. Ignition. Fuel tanks.

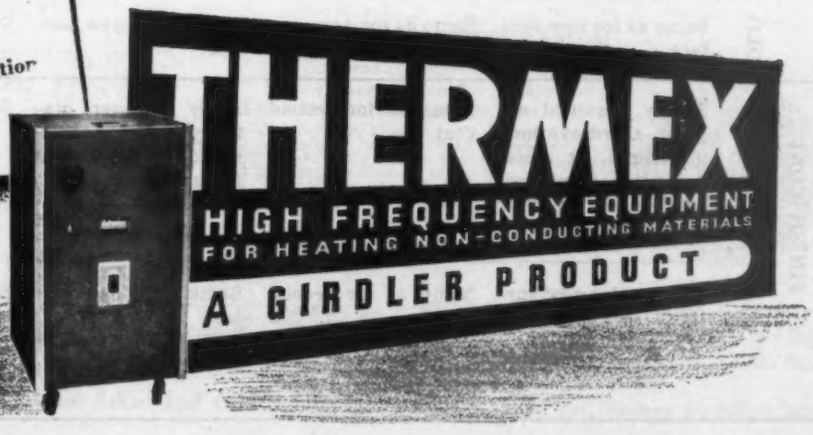
BUY *another* WAR BOND THIS WEEK

For heating practically *any* non-conducting material, investigate the suitability of Thermex high frequency equipment.

Heating with Thermex offers many *speed*, *quality* and *production* advantages heretofore impossible. Temperature is *uniform* regardless of thickness or area of product. Heating time is reduced from hours to minutes in many cases—is under complete control every moment.

The **GIRDLER CORPORATION**

Thermex Division — **Louisville, Kentucky**



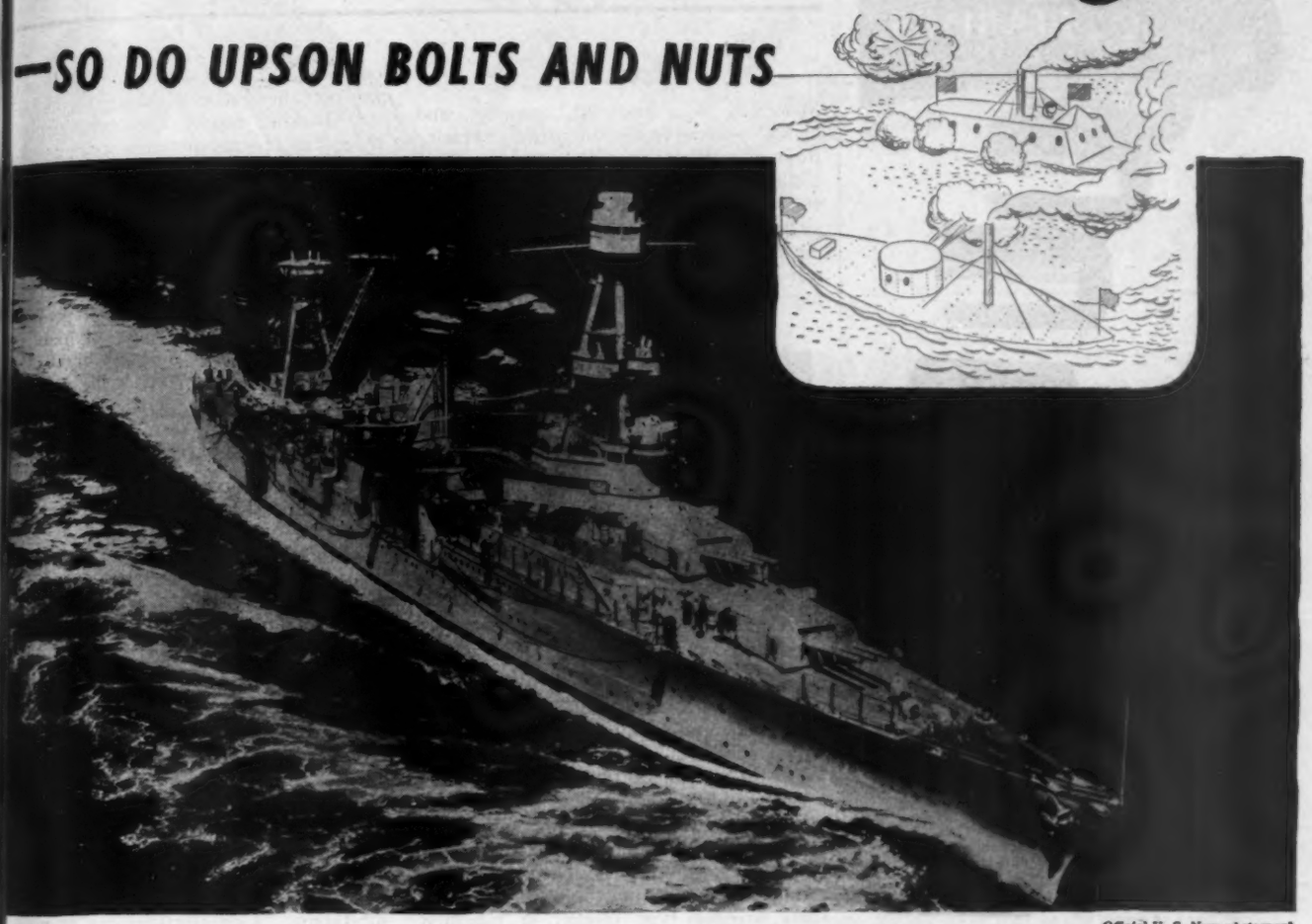
Painting Building Surfaces *(Continued from page 164)*

Exterior Surfaces

		STEEL	WOOD (except floors)	CONCRETE (except floors)	BRICK	GALVANIZED SHEET
PREPARATION OF SURFACE	NEW	Remove dirt, rust, loose scale. Clean off oil, grease with suitable solvent. Sandblast, if possible; otherwise scrape and wire brush thoroughly	Clean off dirt. Apply shellac or other sealer to knots and resinous spots. Putty holes, small cracks	Remove loose material with wire brush. Cut out cracks. Caulk with oil-base caulking compound. Let dry before painting	Remove dirt, grease, loose material. Point cracks with rich mortar mix	Remove dirt, oil or grease. Wash with solution composed of Toluol, ½ gal. Acetone, ¼ gal. Den. alcohol, ¼ gal. Hhdrochloric acid, 3 fluid oz.
	OLD	Sandblast, wire brush, or chip thoroughly to remove rust, loose scale, and old paint	Scrape off loose paint. Burn and scrape off if paint is badly cracked or wrinkled. Sand to remove gloss. Putty holes, small cracks	Clean with wire brush. Apply one coat of primer over bad spots	Same as for new surface	Sandblast, wire brush, or chip thoroughlt to remove rust, loose scale, and old paint
PRIME COAT	NEW	Apply well-brushed coat of effective rust-inhibiting paint	Apply white lead and /or zinc oxide in linseed oil vehicle, or primer recommended by paint manufacturer	Apply coat of exterior masonry primer recommended by paint manufacturer	Same as for concrete	Let dry overnight. Apply galvanized iron primer
	OLD	If steel is exposed, prime with rust-inhibitive paint, as on new surface	If wood is exposed, prime as for new surface	Same as for new surface	Same as for concrete	Same as for steel
SECOND COAT	NEW	For two-coat job apply linseed oil paint, alkyd synthetic enamel (depending on type of primer), or metal protective paint recommended by paint manufacturer. If three-coat job, apply intermediate coat recommended by paint manufacturer	Apply lead-zinc-titanium paint with linseed oil vehicle, or paint recommended by manufacturer	Touch up suction spots (light areas) with primer. Apply exterior masonry finish recommended by paint manufacturer	Same as for concrete. Be sure that primer is dry	Same as for steel
	OLD	Same as for new surface	Same as for new surface	Same as for new surface	Same as for concrete	Same as for steel
FINISH COAT	NEW	Apply linseed oil paint, alkyd synthetic enamel, or metal protective paint recommended by paint manufacturer	Same as for second coat	Apply exterior masonry finish recommended by paint manufacturer	Same as for concrete	Same as for steel
	OLD	Same as for new surface	Same as for second coat	Same as for new surface	Same as for concrete	Same as for steel

When Times Change

—SO DO UPSON BOLTS AND NUTS



Official U. S. Navy photograph

Change comes rapidly. What was modern only a few years ago is obsolete today. The Republic Upson Quality Bolts, Nuts and Rivets that did such a good job of holding ships together more than a quarter of a century ago couldn't stand the strains resulting from increased size, speed and power of our modern "battle wagons". But the tougher, stronger headed and threaded products that bear the Upson name today can—AND DO—because they have been improved time and again as change demanded.

Upson products have been doing an outstanding job of holding things together for 88 years. They're widely used in shipbuilding and marine machinery—in the exacting service of automotive, railroad, petroleum and farm equipment—in machines and structures of every description—and in the airplanes, tanks, trucks, guns and other mechanized fighting tools on today's battle fronts.

When wartime priorities yield to peacetime demands, you'll find Republic Upson Quality products ready to do the jobs of tomorrow—bolts, nuts and rivets further improved over the high quality which already has made the name UPSON famous.

REPUBLIC STEEL CORPORATION
Bolt and Nut Division
Sales Offices • Cleveland, Ohio
GENERAL OFFICES • CLEVELAND, OHIO
Berger Manufacturing Division • Culvert Division
Niles Steel Products Division • Steel and Tubes Division
Union Drawn Steel Division • Truscon Steel Company
Export Department: Chrysler Bldg., New York, N. Y.

REPUBLIC

Upson Quality BOLTS AND NUTS

Other Republic products include Pipe, Sheets, Tubing, Hot Rolled and Cold Drawn Bars—Carbon, Alloy and Enduro Stainless Steel

Machine Finished

Save time . . . avoid trouble in securing plain bronze bearings . . . by Specifying JOHNSON General Purpose. Every bearing is machine finished ready for assembly. They last longer . . . operate more efficiently. Over 800 sizes to choose from . . . twenty warehouses to serve you. Write for new catalogue . . . today.

JOHNSON BRONZE CO.

Sleeve Bearing Headquarters

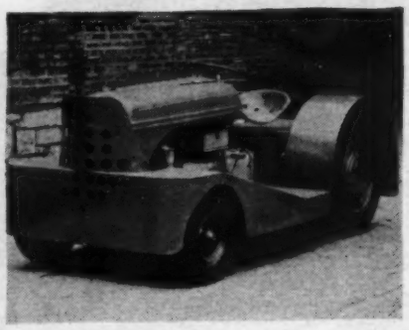
512 S. MILL ST., NEW CASTLE, PA.

Specify JOHNSON BRONZE

WHAT'S NEW IN EQUIPMENT

Tractor

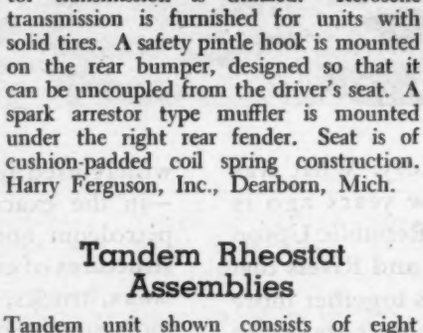
Moto-Tug is a low-built, compact, and highly maneuverable industrial vehicle. Built in two models with drawbar pull of 2500 pounds on single rear wheels and 4000 pounds on duals, overall height is 46 inches, length 112 inches. Outside turning radius is 9 feet, 8 inches. Front and rear bumpers are of armor plate for bucking or pushing purposes, and special



weights provide more traction in sand, ice, snow, and mud. Units are equipped with either solid rubber or pneumatic tires. With the pneumatic tires, a standard tractor transmission is utilized. Kerosene transmission is furnished for units with solid tires. A safety pintle hook is mounted on the rear bumper, designed so that it can be uncoupled from the driver's seat. A spark arrestor type muffler is mounted under the right rear fender. Seat is of cushion-padded coil spring construction. Harry Ferguson, Inc., Dearborn, Mich.

Tandem Rheostat Assemblies

Tandem unit shown consists of eight Model U, 1000-watt, 12-in. diameter rheostats mounted in a steel frame. It is controlled by a single handwheel. Other tandem assemblies can be made up to two, three, or more rheostats ranging in power rating from 25 to 1000 watts and in diameter from 1⅝ to 12 inches. Rheostats are insulated so they may be used for simultaneous control of several circuits or phases of a circuit by means of one knob. To conserve panel space or to use one rheostat as a vernier for another, two rheostats can be separately controlled by means of concentrically located knobs. In this type unit two rheostats are mounted in tandem with the shaft of the rear unit extending through the hollow shaft of the front unit. For increased capacity, the front or back units can consist of several rheostats connected together. Tandem rheostats are also available in taper windings and the same range of resistance values as individual units. Ohmite Mfg. Co., 4835 Flournoy St., Chicago 44.



Women's Protective Hats

Guardi-Ann hat completely covers the hair. Has a shaped crown and perky visor of all-wool felt. An attached rayon snood keeps hair tucked out of harm's way. An air-cooled model has ventilated crown and four eyelets in the visor, placed close to the forehead to prevent pocketed heat. Comes in red, kelly green, turf, tan, black, brown, powder blue, royal blue, navy blue, and wine. Industrial Products Co., 2809 N. 4th St., Philadelphia 33.

Intercommunication System

Model LP-77 is offered as a low-priced, flexible intercommunication system which utilizes in any combination up to ten, both master stations and selector type substations. Conversations can be private

or open as desired. Stations can be placed at any distance up to 2000 feet apart, and variable volume control is adjusted at each master unit from a whisper to full room volume. Operation on the system is 110 volts, a.c.-d.c. Master stations are housed in walnut cabinets and substations are inclosed in metal cases. Available in 10, 20, 30, 40, 50 or more stations. Talk-A-Phone Mfg. Co., 1219 W. Van Buren St., Chicago.

Coolant Pump

Small-sized seal-less coolant pump, especially designed for providing coolant flow to small machines, is less than 16 inches high. Known as Model MVBD, it has three outlets permitting piping arrange-

Save Materials... Increase Production with Leather Belting and MODERN GROUP DRIVES

Save Copper

With Modern Group Drives and Leather Belting, the connected horsepower in the average factory can be cut down 25% to 45%, greatly reducing the amount of copper required for motor windings, control and wiring. For example, *six 5 hp. motors to drive 6 machines require about 120 lbs. of copper for windings alone. With Modern Group Drive, these 6 machines could be driven with one 20 hp. motor, requiring only approximately 55 lbs. of copper, a saving of 54%, plus a further saving in controls and wiring.*

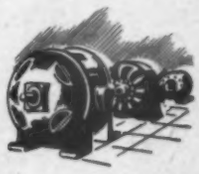
Save Steel

95% of the weight of an electric motor is metal, most of which is steel. A large motor weighs much less per hp. than a small motor. So, by using Modern Group Drives and the comparatively few large motors required by it, great quantities of steel are saved. Six 5 hp. motors contain a total of approximately 735 lbs. of steel, while one 20 hp. motor, which will drive the same machines by Modern Group Drive, contains only about 370 lbs. of steel . . . a saving of 50%!

Save Manpower

It is obvious that fewer "man-hours" are required to build one 20 hp. motor than six 5 hp. motors. So, by using fewer and larger motors in Modern Group Drives, you are helping to relieve the critical shortage of highly-skilled workmen. Because Modern Group Drives with Leather Belting involve fewer parts and controls, they require *less* labor . . . and *no* specially trained labor . . . to install and maintain. Drive elements are readily available, are not complex and can be quickly installed by factory millwrights.

Save Power



Modern Group Drives with Leather Belting *save* power because they require only a comparatively few large motors of correspondingly high operating efficiency. Actual case studies show that in the average factory, drive efficiency is increased 7% and power factor is raised 15%. No other belting material can equal leather for efficient transmission of power. This is directly reflected in the lower consumption of power by the machine for any given rate of production.

Increase Production

Obtaining the maximum rate of output from every machine in your plant is a patriotic duty. Here again, Leather Belting and Modern Group Drives can play a very important part. Machine speeds are more uniform, with the maximum speed also being the average. The pulley-gripping capacity of Leather Belting increases with increased load and can carry through the peak loads without interruption. Both of these factors help to secure the highest possible rate of production from every machine.

Reduce Maintenance

Maintenance of transmission equipment is in direct proportion to the *number* of items involved and is but slightly affected by their *size*. Because Modern Group Drives have fewer parts, they require only one-half to two-thirds as much maintenance as do individual drives for the same number of machines, under the same conditions.

THIS BOOKLET is a practical and authoritative Guide on Leather Belt maintenance . . . how to order . . . how to install. Get a copy from your Leather Belt supplier . . . or write to us.

AMERICAN LEATHER BELTING ASSO.
53 PARK ROW, NEW YORK, N. Y.

Rely on Leather Belting

What's This Little Bostitch Staple Doing in the Frozen North?

IT'S DOING hundreds of jobs for which Bostitching has been selected as the most suitable fastening method — speedy, accurate, secure . . .

Shelter huts have Bostitch-fastened insulation . . . gliders have Bostitched parts . . . deck coverings on landing craft are Bostitch-fastened . . . and there are Bostitch staples in ammunition belts and boxes, ski fastenings, surgical supplies and food containers.

Thousands of manufacturers of war products and civilian products drafted for war . . . metal, wood, plywood, plastics, cloth . . . have adopted Bostitch stapling, stitching, tacking machines for assembly speed . . . in many cases creating entirely new applications. This experience has greatly broadened the range of fastening work for Bostitching . . . and promises new opportunities for better and more economical fastening of many post-war products.

If you have the necessary priorities, find out *now* if the right combination of staple and Bostitch machine . . . selected from a full and complete line . . . can help speed your production. If priorities are not available, investigate *now* so you can apply the latest Bostitch developments to your post-war planning. Bostitch (Boston Wire Stitcher Company), 64 Blackmore St., East Greenwich, R. I. (Bostitch-Canada, Ltd., Montreal).

BOSTITCH

fastens it better AND FASTER with wire

ALL TYPES OF STAPLES APPLIED BY MACHINES
ALL TYPES OF MACHINES FOR APPLYING STAPLES

One of 150 Bostitch staple shapes and sizes. Made of .050" x .070" wire. Shown in actual size.

ments to the right, to the left, or ba into coolant sump through intake bracke Designed to be mounted on outside coolant tank or machine pedestal, it fun tions efficiently with a low water leve The single-phase, heavy-duty motor, tegral with pump body, has totally closed ball bearings. Pioneer Pump & Mf Co., Detroit.

Welding Shield

Designed for extra comfort and complet protection, Huntsman acetylene and ar welding shield has a locking device whic holds the shield in the correct positio before the face. This assures that the lin of vision passes through the lens at rig

angles to the surface of the glass. The de vice holds the shield firmly above the head while the welder is preparing or surveying his work. When welding is resumed, a nod of the head lowers the shield into working position. The locking device automat ically adjusts the shield to the same posi tion each time. Available in six models the weight of the shield ranges from 1 to 1½ pounds. Davis Emergency Equipment Corp., 55 Halleck St., Newark, N. J.

Conduit Nuts

AN conduit, coupling, and lock nuts, fabr ricated from sheet aluminum, are claimed strong as machined nuts and lighter in

ONLY AN ELECTRICAL WHOLESALER COULD THUS SPEED WAR PRODUCTION

"These boats are designed to strike and strike hard, to do damage where it will do the most good and quickly."
Such was the description of two sub-chasers today being fitted for service at Shelburne Har-
SC 1030

"Electrical fittings by Wesco"—190 of them

Products of 45 Manufacturers Assembled to Speed Historic Sub-Chaser Launching

When two 110-foot sub-chasers hit blue water recently, it was the first launching of combat vessels on Lake Champlain since the year 1812. Each sub-chaser's electrical fittings consisted of 190 separate items, ranging from a door switch to an automatic alarm system. Products of 45 manufacturers were involved.

Wesco ordered, assembled and delivered each set of 190 units—built to Navy specifications—before the deadline date. With Wesco as sole source of supply, complications, errors and expense were saved. The customer's office procedures were simplified by the elimination of 45 separate orders, 45 acknowledgments, 45 checks and countless follow-ups, bills of lading and invoices.

Once more, Wesco, trained in the quick assembly and delivery of every type of electrical product, helped speed war production. After Victory, this service-ability will again be yours to command as you convert to the business of peace.

WESCO SPEEDS WAR PRODUCTION

* On the frigid Northwest Coast 16 floodlights were urgently needed for lighting emergency airfields. The manufacturer required 10 weeks to make delivery. Wesco had the equipment on the way in 18 days.
* A flood ruined the machinery and electrical equipment of an important war plant. Wesco's prompt delivery of 22 electrical items made by 6 manufacturers saved this plant 28 days delay.

WESCO SERVES BUSINESS

* By offering prompt delivery of electrical items from local stocks.
* By maintaining perpetual inventory records.
* By providing trained sales and engineering personnel.

Westinghouse Electric Supply Co.

150 VARICK STREET . . NEW YORK (13), N. Y.

A NATIONAL DISTRIBUTING ORGANIZATION WITH 80 BRANCHES

THE *Strategy* OF MAN-POWER

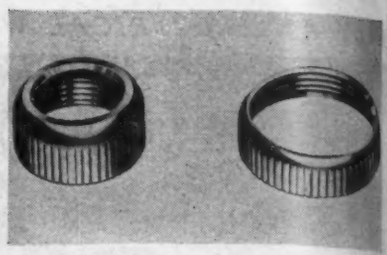
RELIEVING VITAL MAN-POWER of unnecessary fatigue . . . avoiding unnecessary handling . . . saving unnecessary steps . . . keeping a constant flow of material moving to waiting hands and machines, that's man-power strategy headed towards victory.

America's war industries from coast to coast are improving their per-man-and-machine-hour production schedules with the aid of Mathews Time-Coordinated Conveyer Systems.

MATHEWS CONVEYERS FOR MECHANIZED PRODUCTION

If you are manufacturing war material, or anything vital to the success of the war effort, you can get Mathews Conveyers to handle that material. Rely as usual on your Mathews Engineer.

MATHEWS CONVEYER COMPANY ELLWOOD CITY PENNSYLVANIA



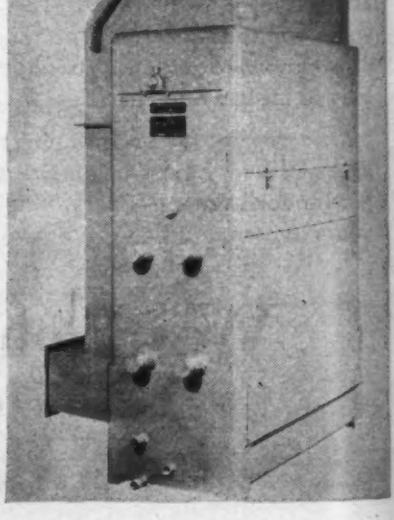
weight. AN 3054 series of coupling nuts is being produced in sizes 3, 4, 6, 8, 10, 12, and 16. The Rumsen Co., 8059 Melrose Ave., Los Angeles.

Floating Glass

So light it floats, Foamglas is a new insulating material, also applicable to floats, building blocks, and other uses. Impervious to acid atmospheres or solutions, this non-critical material can be cut into any shape with saw or knife. Because dampness has no effect on Foamglas, it is recommended as insulation for cold storage rooms. Non-combustible, it can be used as insulation for backup in many types of ovens and furnaces up to a maximum temperature of 1000 deg. F., according to the manufacturer. Weighs 10 to 11 pounds per cubic foot as against 156 pounds per cubic foot of ordinary glass. Pittsburgh Corning Corp., Pittsburgh.

Heat Exchanger

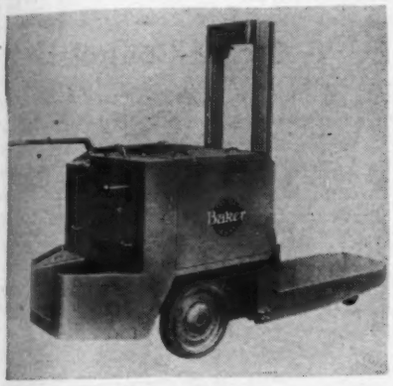
Aero heat exchanger, for automatically adding heat to industrial liquids to maintain constant temperatures, has been announced. The heating device is put into operation by thermostatic control at the desired point, preventing the liquid from becoming too cold for the process in which it is used, or from becoming viscous with retarded flow and loss of capacity, or from congealing or freezing. The heat exchanger may be installed outdoors and fresh air used to increase evaporative cooling capacity, thus avoiding damage from handling air containing corrosive substances. Is used to control temperatures in industrial chemical process, and electrical equipment



by controlling jacket water temperatures, and is also applicable for air and gas compressors. Niagara Blower Co., 6 E. 45th St., New York 17.

Lift Truck

Type H-2 Hy-Lift truck of 4000-lb. capacity is companion truck to type E-2, and can be used interchangeably in the same materials handling system. The truck is built on a 66-in. wheelbase; overall length, including the operator's guard, is 123¾ inches and the truck is designed for operation in intersecting aisles 67 inches wide. Overall height of 83 inches permits maximum lift of 67 inches. Platform is 26½x54x11 inches high in the low position. Hydraulic lift system provides positive control of hoisting and lowering. The control lever, convenient to the operator's right hand,



starts the pump motor and closes the valve forcing oil into the jack cylinder. Lowering is by gravity controlled by the same lever. Limit switch shuts off the pump motor at the upper limit of platform travel with auxiliary safety through a relief valve. Platform travels vertically on ball-bearing rollers running in upright channel guides. Power is supplied by a single hydraulic jack, and travel is compounded by sprockets and roller chains. All controls, together with lift motor and pump, are in a convenient control panel and are readily accessible. The operator's guard is built integral with the frame for greater strength and safety. Right side forms a handy compartment for carrying towing chain, pinchbar, or other tools. Industrial Truck Div., The Baker-Raulang Co., Cleveland.

Oil Reconditioner

Oil-treating unit is designed for reconditioning cutting, grinding, and honing oils which should be heated before filtering. Equipment consists of a 100-gal. mixing and heating tank equipped with electric immersion heaters, mechanical agitator, thermometer, and filter aid storage box of 50-lb. capacity. Has a main line fused knifeswitch, magnetic pushbutton controller, 600-gal.-per-hour filter, rotary pressure pump, and 1-hp. motor. The pump is arranged so that it can be used to transfer the oil from the pump into the heating and mixing tank, and also to pump the oil through the filter. The tank will heat 100 gallons of oil from 80 to 180

COMBAT LOST MAN-HOURS

with MUSIC

HERE'S WHAT WAR PLANTS REPORT

LOWERED ABSENTEEISM

LESS "REJECTS"

FEWER ACCIDENTS

If the manpower problem has you "over a barrel," send for free booklet showing how Operadio Plant-Broadcasting systems maintain or *increase* production . . . even with a reduced number of workers or a high percentage of new and perhaps untrained personnel!

Records show how music scientifically selected for fatigue relief helps speed vital war production, reduces "rejects" and spoilage, lessens absenteeism and accidents. Learn how output is increased on production lines thought to be operating at peak efficiency! The same Operadio system used for music also serves for *voice-paging*—the modern way to *find your man faster*—give orders, get answers in a flash! One factory credits voice-paging with a saving of 4,000 man-hours per month! Another reports that 650 individuals were located during the first 8 hours of voice-paging operation—and 95% of the calls were answered within 60 seconds!

WRITE OR WIRE ➔ for *free booklet* today. Or use coupon below.

MUSIC AND VOICE-PAGING • TIME SIGNAL AND ALARM

BY THE MAKERS OF "FLEXIFONE" INTERCOMMUNICATION

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PIN TO YOUR LETTERHEAD

OPERADIO MFG. CO., DEPT. F-5, ST. CHARLES, ILLINOIS

☐ Please send free copy of new booklet "Music and Manpower."

☐ Have representative survey our needs and estimate cost.

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YOUR NEXT MOVE toward Greater Plant Efficiency

use

BLACKMER
•ROTARY•
HAND PUMPS

for Dispensing—

Oils
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Chemicals
Solvents
Gasoline
Thinners
Alcohol
Kerosene
Acetone

Or any other liquids FROM BARRELS, DRUMS or TANKS

Capacities 7 to 25 GPM. Made in 54 standard units. "The RIGHT PUMP for every job".

SELF-PRIMING

These pumps will handle suction lifts up to 20 ft. without a foot valve. They require no priming.

SELF-ADJUSTING for WEAR

"Bucket Design", swinging vane principle makes these pumps self-adjusting for wear.

Blackmer Hand Pumps are made with the same precision and careful testing that accounts for the high efficiency and long life of Blackmer power pumps. 20 years of continual service is not unusual for a Blackmer hand pump.

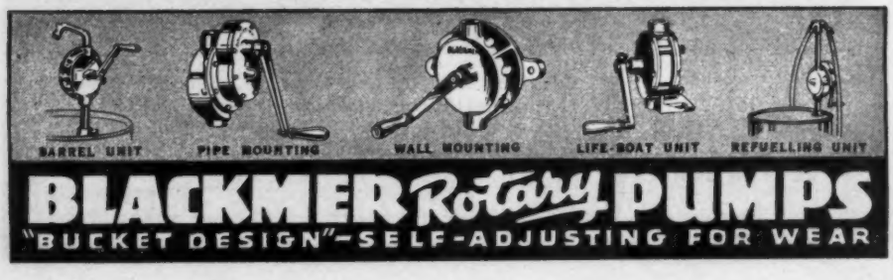
AUXILIARY PUMPS *for* FIRE PROTECTION

Many plants have installed water drums with Blackmer hand pumps and hose for combating roof fires in case of failure of regular water service.

Write for Bulletin No. 205—"Rotary Hand Pumps".

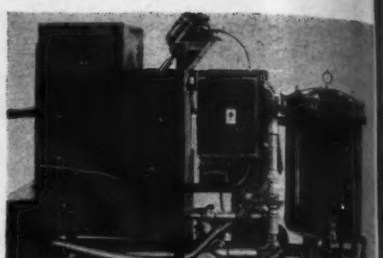
BLACKMER PUMP COMPANY, 2109 Century Ave., Grand Rapids 9, Michigan

POWER PUMPS 7 TO 750 GPM—TO 300 PSI.



BLACKMER Rotary PUMPS

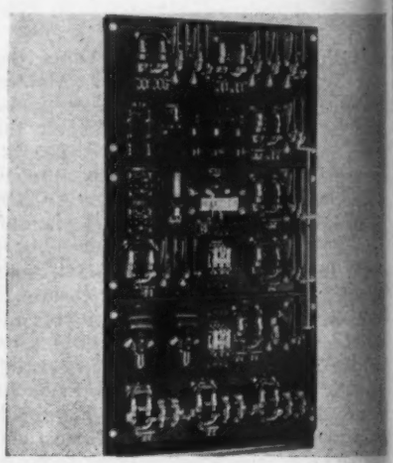
"BUCKET DESIGN"—SELF-ADJUSTING FOR WEAR



deg. F. in 30 minutes, according to the maker. It is claimed that sulphinated, lard, lubricating, and other oils can be restored to their original efficiency and sterilized with this equipment. Machine is portable and compact, and two lengths of neoprene hose are supplied. Measures 25x72x58 inches. Sparkler Mfg. Co., 308 Lake St., Mundelein, Ill.

Crane Control

Alternating current crane control provides dynamic lowering on all points. Retarding torque increases as master switch is notched back. In the "off" position, maximum dynamic braking is combined with an auxiliary electrically operated brake for a quick, complete stop. Mechanical load brakes are eliminated with the a.c. control. Using a standard 5-speed master switch, five definite, stable selective lowering speeds are provided. Empty hook lowers at from 10 to 90 percent of full load hoisting speed; full load lowers at from 40 to 150 percent of full load hoisting speed. Accurate inching for spotting loads, and timed acceleration in both directions from the standard 5-speed master switch are possible with this perfected control. Cutler-Hammer, Inc., 315 N. 12th St., Milwaukee.



Precision Surface Plates

For use in inspection, toolroom, and production departments, these precision surface plates are made of a natural granite which is practically indestructible under normal conditions. They are finished to 1/10,000 of an inch over all, with 100 percent bearing surface. Plates do not

IN THE TIGHT SPOTS IT'S A STAR

To meet special market conditions, **The American Can Company** engaged STAR to accommodate a 25-cycle motor to a 60-cycle space in their high speed can-closing machine. This meant fitting the horsepower required to a space of smaller diameter. STAR—as usual—*engineered* this ticklish "tight spot" successfully through its unique welding process without special molds or castings. Just another example of Star performance which combines the flexibility of specialized application and engineering with standardized design.

Star Electric Motor Company
Bloomfield, N. J.

For 33 years, Star Motors have provided a complete line of standard as well as special motors—in sizes from ½ to 200 H.P. Today they provide dependable power for many applications. Write us about your requirements.

POWER PACKAGED AS YOU NEED IT

ARMY E NAVY

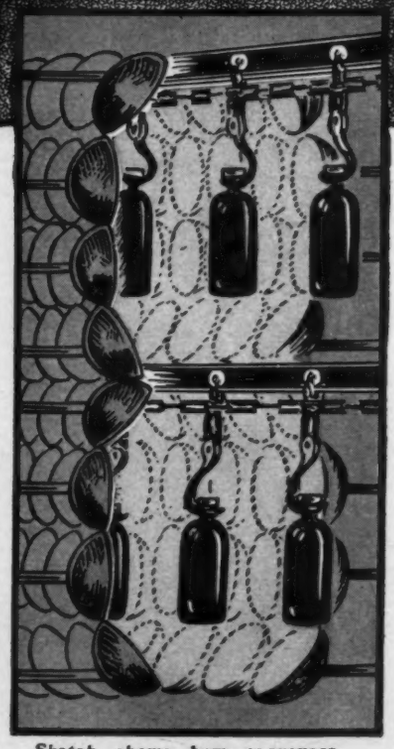
STAR MOTORS

6 YEARS' Production IN 1 YEAR!

... with 10% Less Help

★ One of our customers was striving to produce more oxygen cylinders for the Army and Navy. Floor space limitations had set a production ceiling of (censored) per month. The finished cylinders had to be painted, and the paint allowed to dry.

A Lamson engineer, working with company officials, suggested two Overhead Conveyors, realigning their operations and installing Infra-red drying *overhead,* there being no room elsewhere. They are now getting six years' production in one—with less clutter on the floor—*and with 10% less help!*



Sketch shows how conveyors move cylinders through double bank of Infra-red lights, saving floor space and stepping-up production

How Lamson Conveyors achieved this and other spectacular production increases is told in our latest pamphlet. Free on request. Ask for Bulletin FM-9.

LAMSON CORPORATION

SYRACUSE, N. Y.

Makers of CONVEYORS and PNEUMATIC DISPATCH TUBES

swedge or become charged with abrasive materials, and work can be done with smooth action and close tolerances. The Herman Stone Co., 1238 Leonhard St., Dayton, Ohio.

Tire Removing Kit

Bead-loosener, which is claimed to remove tires of any size quickly and easily, comes in a kit 38x6x6½ inches, weight 48 pounds. The tool includes a metal bar, hooked at one end, with an adjustable lever attached near the straight end of the bar, and two adjustable hooks. With the tire laid flat and deflated, the tool utilizes a system of hooks and leverage

to force any bead loose from its rim in a few minutes, no matter how firmly the rubber and metal are joined. Used properly, the manufacturer claims the tool cannot injure tire or rim. To simplify mounting of tires the kit contains also a valve holder, repair tool, and extension; tire irons; a hammer of rubber and metal; and a strap. Kit permits easy mounting of a tire by one man, without other equipment, and a hook on the bead-loosener allows use of the tool in pulling the rim out of the tire after it has been loosened. Firestone Tire & Rubber Co., Akron, Ohio.

Drafting Machine

Junior Drafter, which can be mounted on a portable board for use in shop or field, is announced. Accurate, parallel motion over the entire board is claimed. Has full circle baseline setting; prelubricated, double-sealed ball bearings; and inclosed pulleys. Disk brakes at anchor and elbow allow the drafter to be used on steeply in-

The POSTWAR *Automatic* Screw Machine is Here

GIBBS Model 375 AUTOMATIC

Turning . . . Forming . . . Drilling . . . Reaming . . . Threading . . . Knurling . . . Counterboring . . . Undercutting . . . Tapping . . . Slotting . . . Spotting

NOW!

What every manufacturer is looking for in the machine tools he buys today is . . .

1. ***Top-speed* war production now, plus assurance of**
2. ***Low-cost* production in the postwar period to come.**

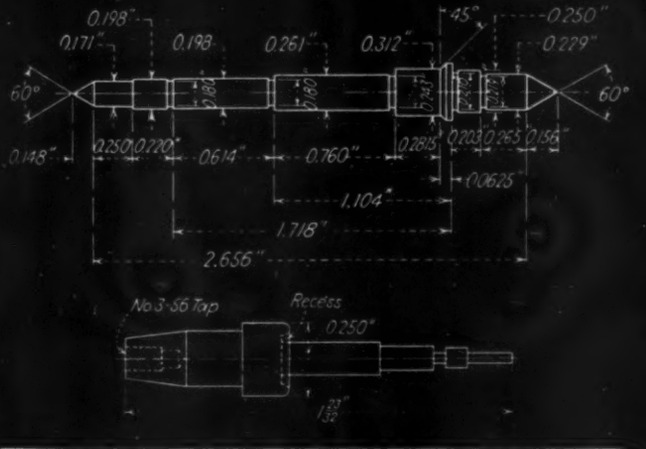
That's why the Gibbs Model 375 Automatic Screw Machine is being made available to American industry at this time . . .

For the Gibbs Automatic is a completely up-to-the-minute machine tool capable of mass-producing small precision parts . . . at high speed . . . to tolerances as close as .0002" . . . and using men and women operators with only average skill.

5 cutting tools and 5 special Gibbs attachments give the machine the widest possible range of machining operations. In fact, in scores of war industries, the Gibbs Automatic has already proved its war worth in turning out hundreds of different intricately shaped small parts from bar stock.

Of course your top interest today is war production. But you probably also have an eye on the future when low-cost operation will once more become all-important. In either case, and for *both* reasons, you'll want to know more about the Gibbs Automatic.

Fully automatic—it will do all of these operations in one production cycle...



Submit any "Small-Piece" problem to Dept. 6. No obligation to you, of course.

SEND FOR THIS BOOKLET

Booklet S-102 is yours for the asking. It illustrates the many exclusive features of the Gibbs 375 Automatic and shows how it can make small precision parts for you at high speed and low cost.

THOMAS B. GIBBS & COMPANY

DIVISION OF THE GEORGE W. BORG CORPORATION

DELAVAN, WISCONSIN

Silver Streak Abrasive Belts On Belt Grinders Eliminate "Traffic Jams" On Larger, Slower Millers and Shaping Machinery!

Hundreds of busy shops save up to 50% of tool and parts grinding by utilizing small, speedy and accurate belt grinders equipped with SILVER STREAK Abrasive Belts. They turn out work faster and better . . . without "tieing-up" bigger, more important shop machinery. With fine grit Silver Streak, they are able to grind down to tolerances of .0005 with ease.

MAKE A TEST . . . with *FREE SAMPLES!*

Give Silver Streak Belts a trial on any one of your supplementary grinding jobs . . . WE WILL SUPPLY YOU WITH *FREE* SAMPLES FOR ANY TEST YOU WANT TO MAKE. There's no obligation . . . just write us the details, tell us the grit and size of belt you require. We want to prove to you that no matter what kind of a grinding or polishing job you're doing, Silver Streak will help you do it better. And, you'll get longer life out of every Silver Streak Belt, besides! Abrasive Products Inc., 519 Pearl Street, South Braintree, Massachusetts.

Insulated to withstand grinding heats up to 1700°, Silver Streak Belts keep cutting long after ordinary belts have quit.

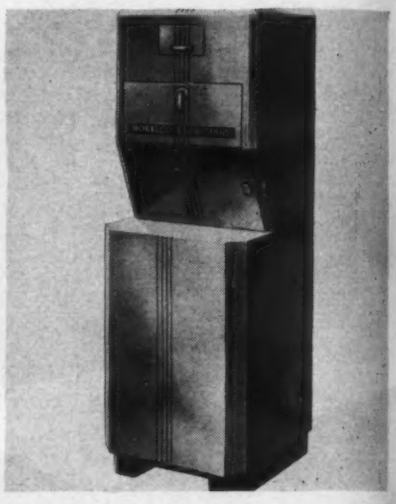
Made with AP's exclusive Velvet Joint, Silver Streak Belts won't bump or jump on the work.

ABRASIVE PRODUCTS
SOUTH BRAINTREE MASSACHUSETTS
JEWELOX • JEWEL EMERY • JEWEL GARNET INC. JEWELITE • JEWEL FLINT • NEW PROCESS

clined boards. Central skid button is plastic. Lightweight aluminum scales are available in 8- and 12-in. lengths and fit into slotted chucks in the positive scale holder. Protractor is 3¾ inches in diameter and graduated in degrees with figures by quadrants. The drafter is flexible so that the scales lie flat, and the head can be raised high off the board. V & E Mfg. Co., Pasadena, Calif.

Electronic Inspection Unit

Searchray, which is both fluoroscopic and radiographic in action, can be operated safely by unskilled personnel for X-ray inspection, according to the maker. The unit plugs into any standard 110-volt power supply. Object to be inspected is placed in the compartment, a button is pressed, and the object can instantly be seen fluoroscopically through the eye-level eyepiece. Safety for the operator is assured by a ray-



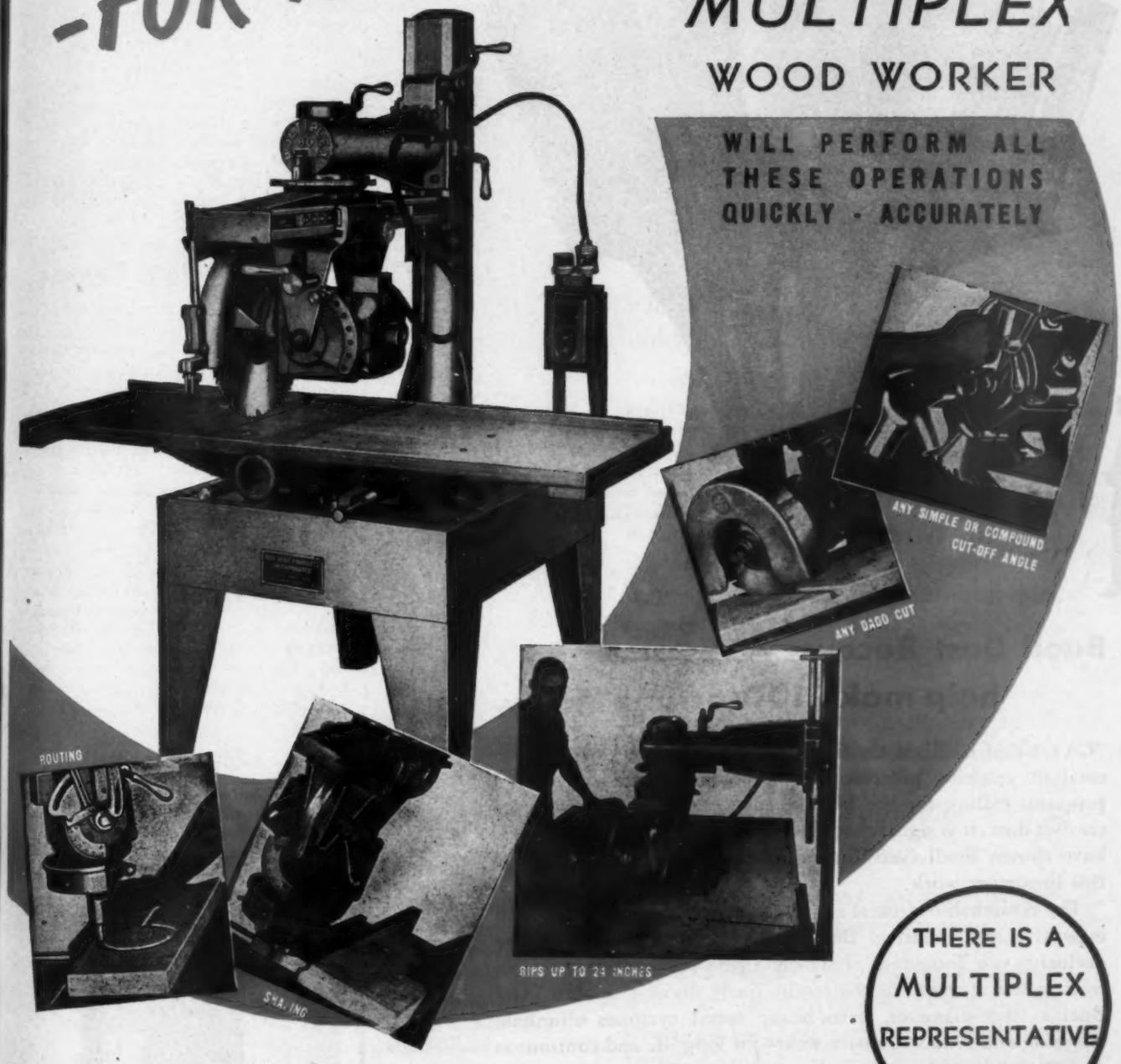
proof, shockproof housing with full automatic electric interlocks which interrupt the circuit while the compartment door is open. Searchray is supplied with accessories which permit radiographic examination covering a maximum area of 11x14 inches, using standard 12x14-in. X-ray film or paper. Article compartment is 21 inches long, 18 inches deep, 9 inches high. Fluoroscopic screen measures 12x16 inches with 8½x11½ inches being the maximum area observable at any one time. Unit takes up less than 5 square feet of floor space. Industrial Electronics Div., North American Philips Co., Inc., 419 Fourth Ave., New York.

Motor-Alternator Sets

Line of two-bearing, 3600 r.p.m. motor-alternator sets in integral ratings up to 5 kva., single-phase, has been announced. Compact and lightweight, these sets are designed for converting direct current to alternating current for various applications. In operation, the d.c. motor drives the alternator, which has a field connected in series with the motor armature. An increase in the alternator load causes an increase in the motor load, so that increased d.c. is drawn from the line. The greater d.c. current strengthens the alter-

FOR ODD JOBS - -FOR HEAVY PRODUCTION

A SINGLE *MULTIPLEX* WOOD WORKER


WILL PERFORM ALL THESE OPERATIONS QUICKLY - ACCURATELY
ANY SIMPLE OR COMPOUND CUT-OFF ANGLE
ANY DADO CUT
ROUTING
SHAPING
RIPS UP TO 24 INCHES

THERE IS A MULTIPLEX REPRESENTATIVE NEAR YOU

Unique design of the Multiplex wood worker accounts for fast change from one operation to another and high accuracy of any cut. It replaces or re-enforces a battery of specialized machines. It is ready in an instant for small pick-up jobs or the heaviest production. There are places in every shop where the Multiplex can save hours and dollars, and do a better job.

2043-W

RED STAR PRODUCTS INC

9455 VEGA AVENUE, CLEVELAND, OHIO

Aide-de-Camp to a

"CAT CRACKER"

Buell cyclones as adapted for oil catalyst recovery in 34 catalytic cracking units

Buell Dust Recovery Systems help make 100-octane gas...

"CAT CRACKER" is the oil industry's nickname for the new catalytic cracking processes now producing high-octane gas—processes calling for the highest efficiency in the recovery of catalyst dust. It is significant that so many leading oil companies have chosen Buell (van Tongeren) Dust Recovery Systems for this important work.

The remarkable natural and synthetic catalysts used are both expensive and abrasive. Buell equipment (incorporating the exclusive van Tongeren "shave-off") pays for itself many times over in the recovery of the costly, finely divided catalyst. And Buell's large-diameter, extra-heavy metal cyclones eliminate clogging and reduce abrasive wear—for long life and continuous performance.

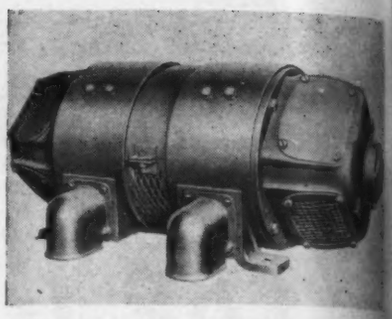
Here, as in so many other fields, Buell leadership has again demonstrated its ability to solve difficult dust recovery problems.

Maybe Buell can help your business...
Write for Bulletin G-842, describing Buell equipment and its applications in many industries

BUELL ENGINEERING COMPANY, INC.
12 Cedar Street, New York 5, N. Y.
Sales Representatives in Principal Cities

buell
DUST RECOVERY SYSTEMS

BUY WAR BONDS AND MAKE THE AXIS BITE THE DUST



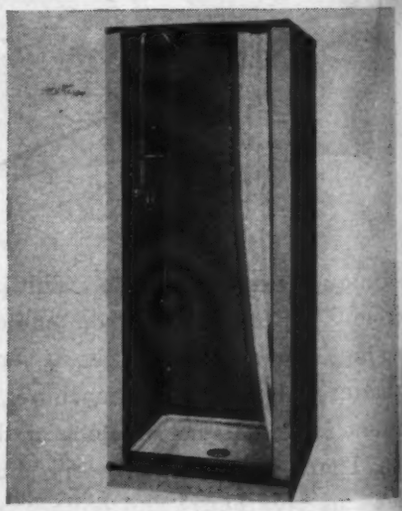
nator series field, tending to maintain a constant a.c. voltage. Motor and alternator are similar in that armature windings are on the rotating elements and fields are stationary, being attached to the frames. A solid shaft, supported by a ball bearing at each end, serves to mount the rotating members of both motor and alternator. Complete rotating unit may be pulled out of the stator by removing an end shield. Motor Div., General Electric Co., Schenectady.

Metal-Coating Process

Developed to expedite application of heavier silver coatings specified on many government projects for bus bars, lugs, and other parts of electrical equipment, metal-coating process requires three basic items: Electrolyte, metal cleaner, applicator. Plating current for small jobs can be obtained from dry batteries, storage battery, or any source supplying direct current at 3 to 6 volts. Standard applicators are available in three sizes. Plating rectifier for 110-120 volt, 50-60 cycle a.c. circuit is recommended for large quantities of work, and will supply current for up to three applicators. Claimed quick and positive, the process can be used also for plating, replating, or touching up rust- and corrosion-resistant coatings of other metals. Available in silver, cadmium, tin, copper, zinc, nickel, and gold. Rapid Electroplating Process, Inc., 1414 S. Wabash Ave., Chicago 5.

Shower Stalls

Line of Tiletone shower stalls is designed to permit quick assembly of single or multiple units. Walls are constructed of hard but flexible plastic-coated wallboard. Cor-



LO-HED HOIST

. . . speeds up and simplifies operation of 2-ton gantry

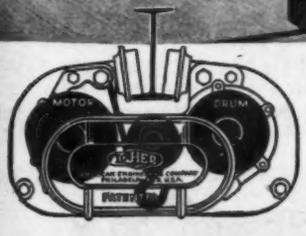
This two-legged gantry crane is entirely independent of the building for support.

A standard 2-ton Lo-Hed Hoist (plain trolley) glove-fitted into the design of the crane because a standard I-beam could be used for a rail, because "balanced construction" of the Lo-Hed permitted the hook to be drawn up to within an inch of the I-beam. That meant low headroom, a desirable plus feature, at no extra cost. Selection of a standard Lo-Hed Hoist facilitated quicker delivery.

In any hoisting job, including applications such as this, look into the possibilities of a Lo-Hed *first*. Write or telegraph for full information on Lo-Hed Hoists.

LO-HED IS THE "BALANCED" HOIST FOR HEAVY DUTY SERVICE

Other important features of the Lo-Hed Hoist are the heavy duty hoist motor; strong, short shafts; heavy duty bearings; 100% positive automatic stop; straight line spur gear drive; and removable protective covers for all vital parts.



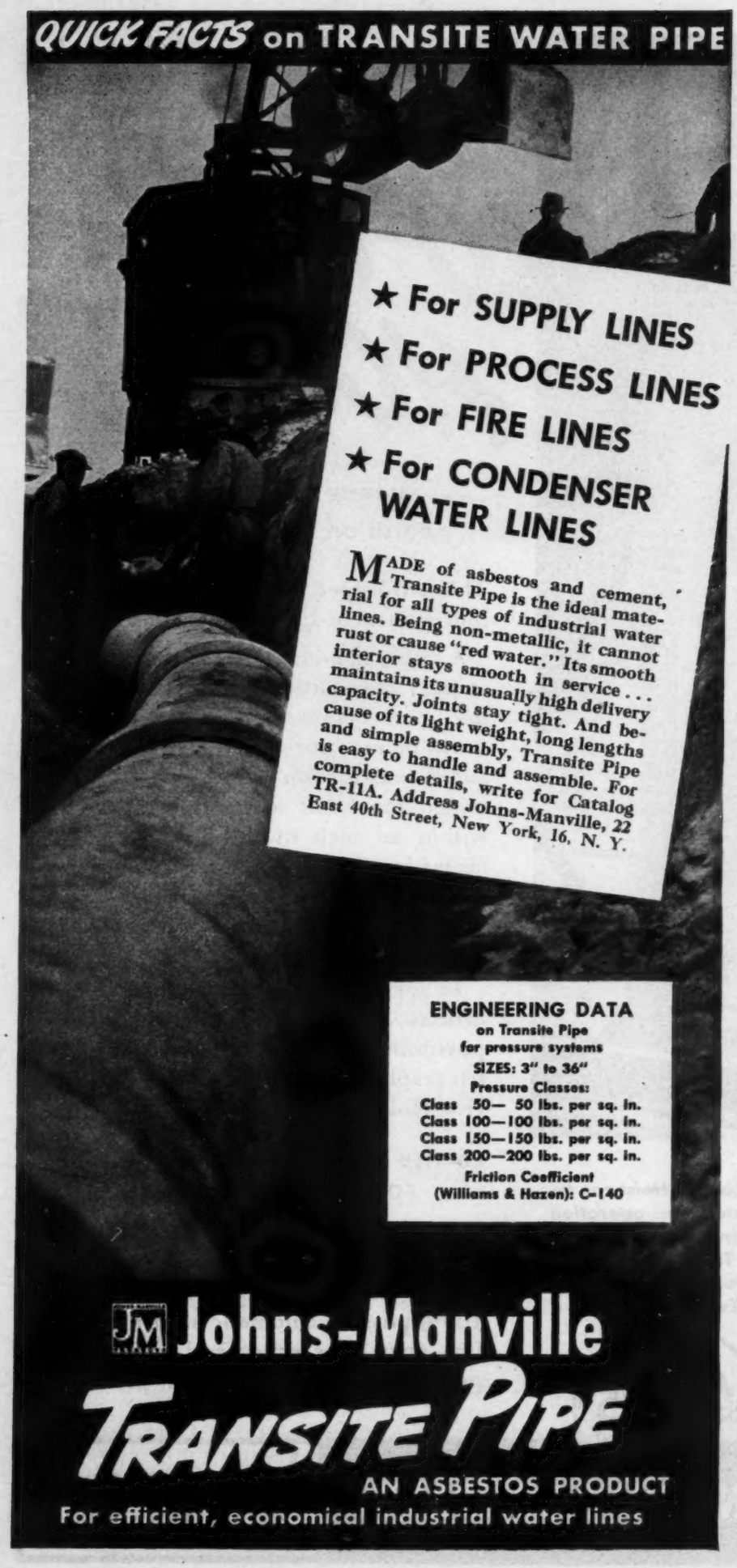
The Lo-Hed Hoist can be adapted for operation on any monorail system. There's a Balanced Lo-Hed Electric Hoist for Every Purpose.

Other A-E-CO Products:
TAYLOR STOKERS
MARINE DECK AUXILIARIES
HELE-SHAW FLUID POWER

Æ CO 75th ANNIVERSARY

AMERICAN ENGINEERING COMPANY

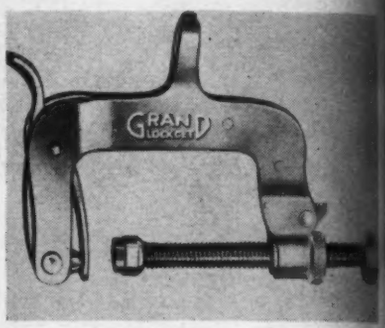
2426 ARAMINGO AVENUE
PHILADELPHIA, PENNA.


QUICK FACTS on TRANSITE WATER PIPE
★ For SUPPLY LINES
★ For PROCESS LINES
★ For FIRE LINES
★ For CONDENSER WATER LINES
MADE of asbestos and cement, Transite Pipe is the ideal material for all types of industrial water lines. Being non-metallic, it cannot rust or cause "red water." Its smooth interior stays smooth in service . . . maintains its unusually high delivery capacity. Joints stay tight. And because of its light weight, long lengths and simple assembly, Transite Pipe is easy to handle and assemble. For complete details, write for Catalog TR-11A. Address Johns-Manville, 22 East 40th Street, New York, 16, N. Y.
ENGINEERING DATA
on Transite Pipe
for pressure systems
SIZES: 3" to 36"
Pressure Classes:
Class 50— 50 lbs. per sq. in.
Class 100—100 lbs. per sq. in.
Class 150—150 lbs. per sq. in.
Class 200—200 lbs. per sq. in.
Friction Coefficient
(Williams & Hazen): C=140
JM Johns-Manville
TRANSITE PIPE
AN ASBESTOS PRODUCT
For efficient, economical industrial water lines

ner posts of 20-gage galvanized steel form water-tight joints with the wall panels. Preceptors are of pre-cast reinforced cement and provide a leak-proof, non-slip base. Stalls are 32 inches square, 75 inches high. Sanymetal Products Co., Inc., 1677 Urbana Rd., Cleveland.

Clamps

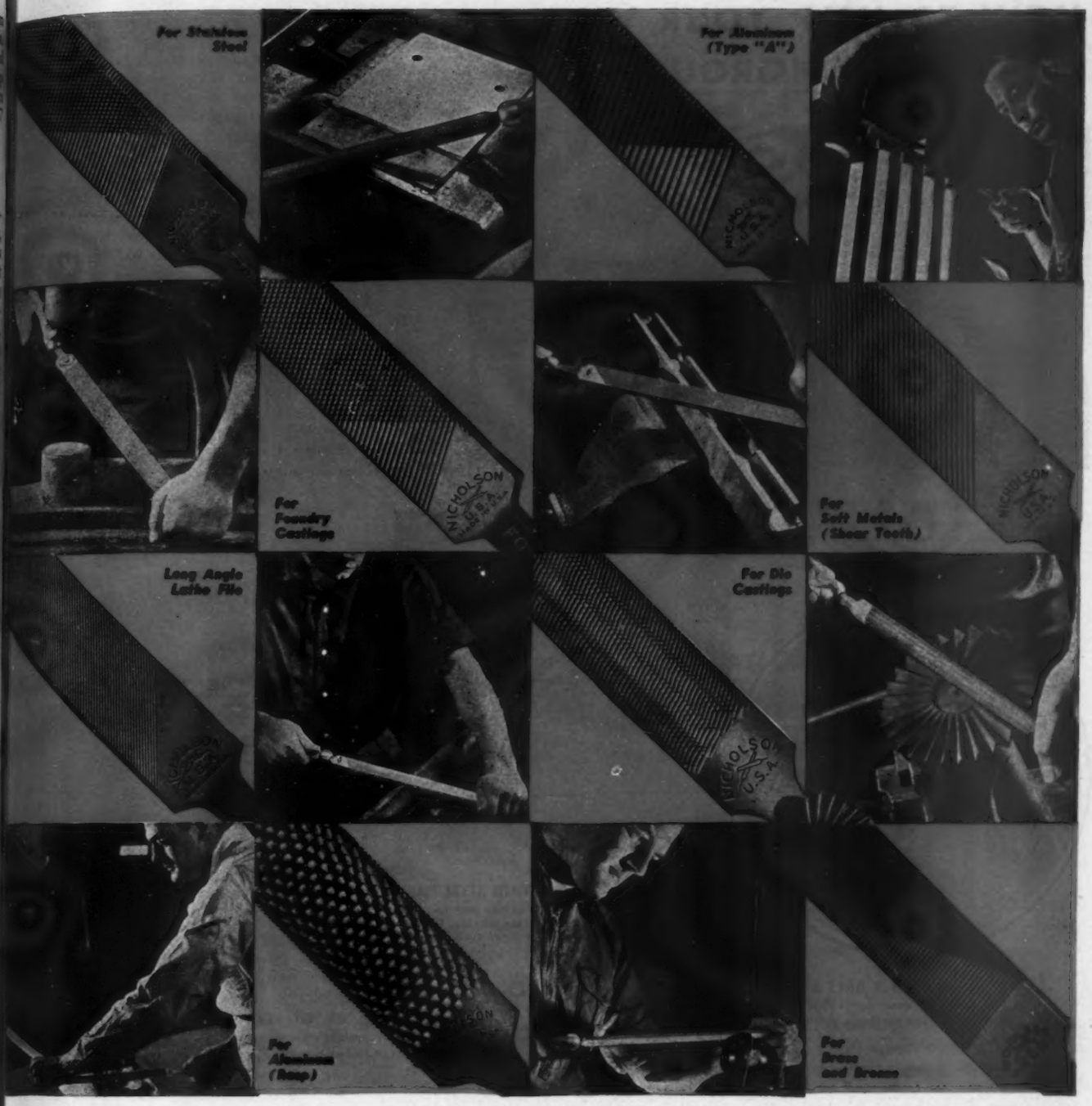
Three new lines of clamps have been announced. Quick Lockcet, which is shown, is designed for light, fast work and has an instantaneous trigger release. The seat of the clamp has a swinging, locking lever gib which is claimed non-creeping. Release trigger is equipped with teeth which, under spring tension, hold a firm grip on the screw, which is released instantly with trigger pressure by thumb or finger so that



the screw may be slipped to any desired position with a single motion for immediate re-setting. Clamp has a free acting swivel with fiber face, and may also be had with all-fiber jaws. Quick Lockcet is made in three sizes. Heavy-duty speed clamp is a two-handed, lever-operated clamp. It is claimed that with combination screw and lever action the clamp can be set and locked for a given opening and instantly applied or released with a single lever movement. Alloy-steel standard C clamps, designed for medium-duty service, have ball and socket swivels. Hardened screws and vise-type handles are copper plated against welding spatter. The Grand Specialties Co., 3101 W. Grand Ave., Chicago.

Portable Test Rig

Unit for testing vibrators, pumps, instruments is compactly mounted on a drilled flat steel base for portability. Vertically mounted 2-hp. motorized P.I.V. gear of 6 to 1 overall speed range is connected to a



The right file speeds the job, cuts the cost

Nothing has ever so sharply emphasized the value of special tools for specific jobs as the mass production programs of our huge war industries.

They justify, conspicuously, this company's far-sighted pioneering in designing many of the special purpose files which today are speeding up thousands upon thousands of individual filing operations.

Besides supplying large quantities of the Nicholson or Black Diamond Special Purpose Files shown above, Nicholson has recently developed a special file for tank armorplate fitting; and another for magnesium filing in incendiary bomb manufacture. . . . Nicholson research never rests—and quality manufacture is never lowered. *Send us your filing problems.*

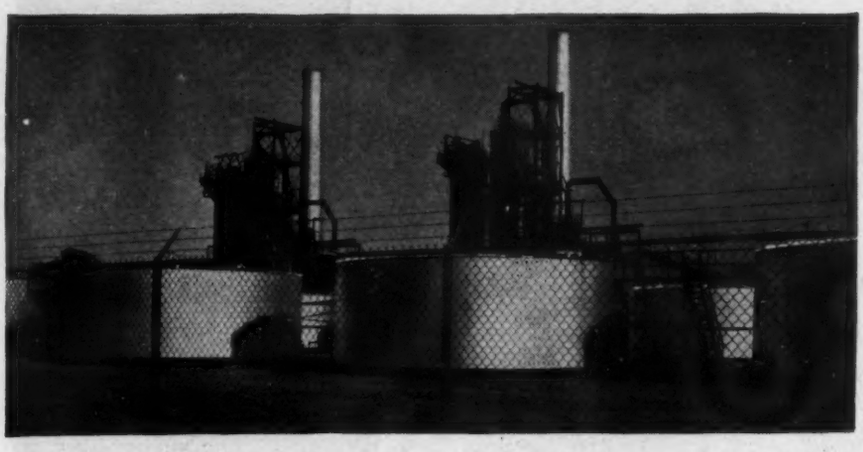
FREE BOOK. Send for *"File Filosophy,"* the 48-page Nicholson book. Tells more about the above-illustrated and other files; about proper use and care of files, etc.

Nicholson File Co., 77 Acorn St., Providence 1, R. I., U. S. A.
(Also Canadian Plant, Port Hope, Ont.)

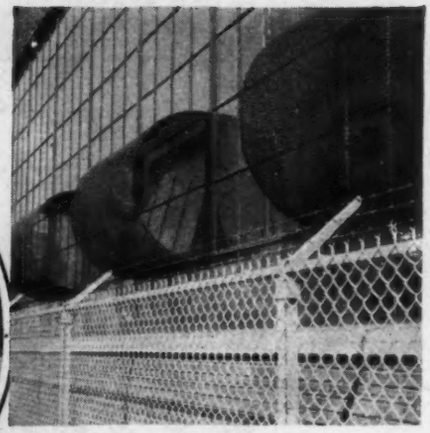
NICHOLSON FILES
FOR EVERY PURPOSE

NICHOLSON U.S.A.

HOW TO HELP YOUR WATCHMAN DO A THOROUGH JOB



1. FENCE EVERY FOOT OF PROPERTY LINE. Be sure that your entire plant is enclosed—including the yards and parking lots. U·S·S Cyclone Fence, with its formidable barbed wire top, will guard your plant against spies and saboteurs—day and night.



2. SCREEN ALL WINDOWS WITH STEEL MESH. Here's the way to be *sure* that no one can toss tools, dies or plans to a confederate outside. Cyclone Window Guards are helping prevent such losses in many plants.

3. PERMIT ENTRANCE ONLY AT GUARDED GATES. Then your guards will know just who has come in or gone out—what he carried with him—and when he passed through the gates. The gate is the strategic point in your plant protection. Keep it closed, well guarded.

REMEMBER—a single weak spot is an invitation to trouble. Check your fencing now. Perhaps a few additional feet of fence will tighten your plant protection. A few window guards may remove a hazard to the safety of your plant or the secrecy of your operations. Demands are heavy and supplies are limited, but if you are doing war work and have the proper priorities, we can provide U·S·S Cyclone Fence and other materials for the protection of your plant. Get in touch with us. We will promptly make a recommendation and give you a free estimate.

CYCLONE FENCE DIVISION (AMERICAN STEEL & WIRE COMPANY)
Waukegan, Ill. · *Branches in Principal Cities*
United States Steel Export Company, New York

USS UNITED STATES STEEL

CYCLONE FENCE

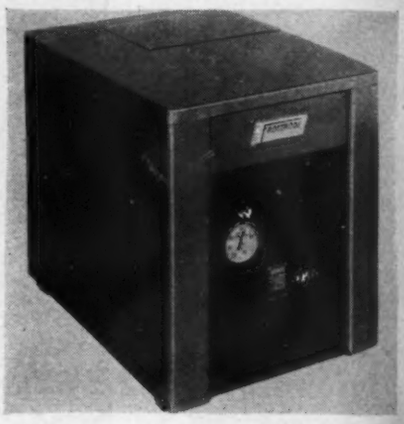
Clip this coupon—and send it to:
Cyclone Fence, Waukegan, Ill., DEPT. 993
We'll send you our free, 32-page book on fence. It's full of facts, specifications, illustrations. Shows 14 types of fence. Before you choose any fence for your property, get the facts about Cyclone. Mail this coupon today.

Name.....
Address.....
City..... State.....
Interested in fencing: ☐ Industrial; ☐ School; ☐ Playground; ☐ Residence. Approximately.....feet.

helical gear box having three output shaft extensions for testing, and a fourth extension for connection to a tachometer. The three output shafts in line have speed ranges of 600 to 3600; 300 to 1800; and 150 to 900 r. p. m. The speed range of shaft extension for tachometer is 150 to 900, and a triple-scale indicator is used for the three speed ranges. Speed of each shaft can be minutely varied by hand regulating wheel. A larger hand wheel operates the vernier control for more precise speed control. Link-Belt Co., 307 N. Michigan Ave., Chicago 1.

Coolant Cooler

Model 75-AC cooler is a self-contained, portable unit. Utilizing an air-cooled compressor, it operates independent of water services. Coolant temperature is selected by setting a dial on the panel of the cooler. Variations in temperature are automatically compensated for by an integral differential thermostat. Single steel tube evaporator coil construction permits uninterrupted flow of coolant. Heat transfer



and compressor efficiency are provided by use of counterflow principle in the evaporator unit. Coolant pressure drop in the cooler is claimed less than 5 pounds psi. at full load. Standard compressor motors are designed for 220/440 volts, three-phase, or 115/230 volts single-phase, and are rated at ¾ horsepower, 60 cycles. Motors for other voltages and for 25 and 50 cycles can be supplied. Rated capacity is 18 gallons of coolant per minute when cooled to 20 deg. F. below room temperature. Frostrode Products, Detroit.

Change in Name

The name of the Dowty Equipment Corporation, Long Island City, N. Y., has been changed to Hub Industries, Inc. There is no change in the directors or officers of the corporation. The company will continue to manufacture the Live-Line hydraulic pump as well as landing gears, gear pumps, hand pumps, filters, selector valves, and related products.

Deep Bowl Reflectors

Designed to confine light rays and throw them directly on work, the reflectors are made in four diameter sizes—7½, 10½, 15, and 17½ inches, with the light center

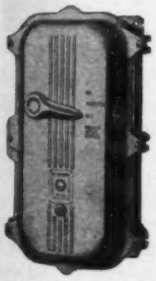
FOR THOSE DANGER SPOTS IN WAR WORK

DANGER *Acetone*

"De-ion" Motor Watchman for manual motor starting.
(Class I and II hazardous locations.)

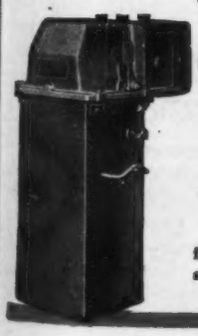
DANGER *Naphtha*

"De-ion" Linestarter for magnetic across-the-line motor starting.
(Class I and II hazardous locations.)



DANGER *Coal Dust*

"De-ion" Combination Linestarter for circuit protection and magnetic motor starting.
(Class II hazardous locations.)



DANGER *Gasoline*

Oil-immersed "De-ion" Linestarter for use in corrosive and explosive atmospheres.
(Class I hazardous locations.)

. . . use Westinghouse "De-ion" Controls for hazardous locations

Controls for motors must "make" and "break" circuits safely in spite of explosive atmospheres in ammunition plants, chemical, oil refining and other war industries. Production must be kept moving . . . and safely!

That calls for Westinghouse A-C Motor Control specifically designed for the job.

Cast-iron or welded steel enclosures with heavily reinforced sections and wide sealing flanges are designed in accordance with Underwriters' Laboratories specifications for Class I, Group D and Class II, Groups F and G hazardous locations.* For those applications where it is necessary to resist the effects of corrosive as well as explosive atmospheres, the Westinghouse line includes many combinations which are totally oil-immersed. These are designed in accordance with Underwriters' Laboratories specifications for Class I, Group D hazardous locations. Other design features keep maintenance at a minimum, provide complete accessibility when necessary.

Whether for replacement or for new installations in hazardous locations, specify Westinghouse Controls. Call your Westinghouse representative for his recommendations. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N.

J-21271

★ ★ ★

*Class I, Group D hazardous locations are those in which the atmosphere contains gasoline, petroleum, naphtha, alcohols, acetone, lacquer solvent vapors, or natural gas.

Class II, Group F and G locations include those in which grain dust, carbon black, coal, or coke dust is present in sufficient quantities to produce explosive mixtures.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

MOTORS AND CONTROL

Leaders ON-THE-JOB

FOR BETTER DUST SAFETY— *BETTER COMFORT TOO!*

THE TRANSPARENT

Clear-Vue MODEL

DUSTFOE RESPIRATOR

With facepiece and filter container of strong, transparent plastic, you can see inside this modern respirator at a glance. Officially approved by the U. S. Bureau of Mines for All-Dust protection, the Clear-Vue Dustfoe is durable, odorless, non-corrosive, non-conductive of electricity or heat. Its transparent construction permits checking for cleanliness, proper insertion and seal of filter, etc., without disassembly, and the self-adjusting facepiece has a soft, molded face-cushion which provides maximum wearing comfort. Easily sterilized; all parts are interchangeable. Write for Bulletin No. CM-6.

M·S·A

Comfo

DUST RESPIRATOR

WITH PLASTIC FILTER CONTAINER

New plastic filter containers—thinner, with rounded edges—permit better downward and sidewise vision in the famous Comfo Respirator, *plus* even lower resistance to air-flow and improved appearance. Long a popular favorite in industrial service, the twin-filter Comfo is U. S. Bureau of Mines-approved for dependable dust protection—sturdy and durable for hard service. Flexible molded facepiece assures snug fit—simple to clean and sterilize. Ask for Bulletin No. CR-9.

DEMONSTRATIONS GLADLY ARRANGED ON REQUEST

MINE SAFETY APPLIANCES CO.

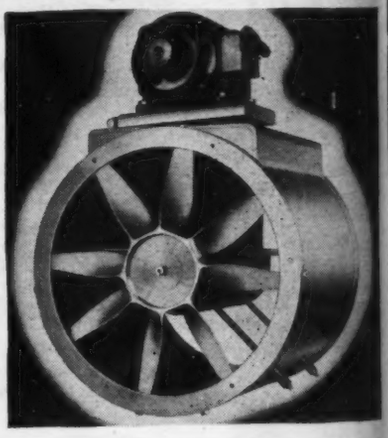
BRADDOCK, THOMAS AND MEADE STREETS

PITTSBURGH, PA.

well inside. Shade holder types are made in several sizes for use with 60- to 200-watt lamps. Detachable socket types are for use with 60- to 1500-watt lamps. Standard finishes are green on the outside and white on the inside, and are of either ultranamel or porcelain enamel. Steber Mfg. Co., 2451 N. Sacramento Ave., Chicago.

Duct Fan

Made in both direct-connected and belt-driven styles, duct fan is built in all sizes from 12- to 55-in. ring diameter and can be supplied with one-propeller, two-propeller, and multi-blade fans. A flanged ring at each end of the fan duct section



allows it to be quickly bolted to the duct in replacing a section, and when electrical connection is made, installation is complete. Both models can be greased from outside the duct section. The belt-driven model, which is recommended for use in ducts through which fire-hazardous fumes or motor-damaging elements are carried, can be adjusted or changed from the outside. Back pressures ranging from very light to fairly heavy can be handled. Hartzell Propeller Fan Co., Piqua, Ohio.

Cable Clamps

Cable clamps for exposed industrial wiring have been designed to provide suitable support for branch feeders from the main distribution system. Quarter-bend clamp provides proper bending radius without injury to the cable, and sweep of this clamp is of sufficient length to make proper bend in cable sizes for which

Shockless

in

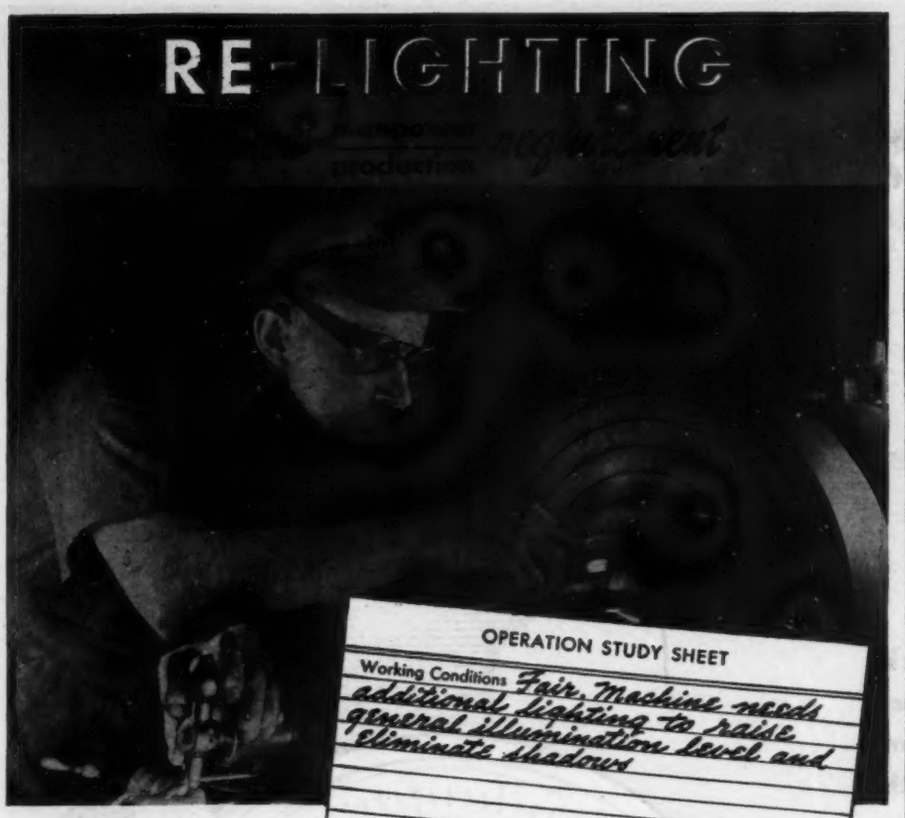
4 Sizes
14 Dials

Ames Hundred Series Shockless Indicators are equipped with a patented wheel assembly that enables them to withstand actual hammer blows on the spindle end without harming the gears, original setting or smooth action. Where shocks or jolts occur in testing or rough and careless handling ruin other indicators, Ames Shockless Indicators give long, satisfactory service at substantial savings.

AMES
Hundred Series
DIAL INDICATORS

Send for Catalog

B.C. AMES CO.. WALTHAM. MASS..U.S.A.


RE-LIGHTING
OPERATION STUDY SHEET
Working Conditions Fair. Machine needs additional lighting to raise general illumination level and eliminate shadows

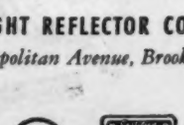
This man needs more light

The plant where this worker is employed—like most plants built before Pearl Harbor—was probably designed for peacetime production, with lighting equipment intended merely to supplement daylight. Hence, *its lighting system is inadequate for wartime night work*—and production falls off seriously on the "swing shifts."

Re-lighting for better illumination will correct this condition, make it easier for workers to see—thus increasing efficiency and production. Re-lighting costs little and is easy to arrange. A Silv-A-King lighting engineer, for instance, can tell you quickly how to re-locate lamps to eliminate glare and shadow...show you where it is necessary to increase lamp wattages or install additional equipment to insure uniform high lighting levels.

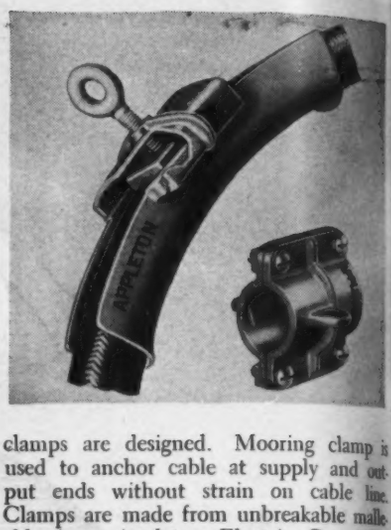
Silv-A-King fluorescent equipment, with reflectors of non-critical Silv-A-Tex, is available for prompt delivery to war plants. Silv-A-King equipment (fluorescent or incandescent), plus a Silv-A-King "engineered layout" make an unbeatable combination.

BRIGHT LIGHT REFLECTOR COMPANY, INC.
1027 Metropolitan Avenue, Brooklyn 2, N. Y.



Send for new Folder 43-V describing Silv-A-King "Victory" Fluorescent Units.

SILV-A-KING MAKES *Light* WORK FOR YOU



clamps are designed. Mooring clamp is used to anchor cable at supply and output ends without strain on cable line. Clamps are made from unbreakable malleable iron. Appleton Electric Co., 1701-1729 Wellington Ave., Chicago 13.

Adhesive Bonding Process

Reanite bonding process is claimed to unite metals with a bond stronger than riveting or spot welding, and to join rubber, synthetic rubber, plastics, leather, or wood to metal or to each other with a bond stronger than the materials themselves. Surfaces to be joined are brushed, sprayed, or dipped with Reanite, and after drying, mild heat and pressure are applied. The joint is claimed unaffected by fresh or salt water, is non-corrosive to metals, and has high dielectric strength. Tests have shown a metal-to-metal bond ranging from 1000 to 3000 lb. per sq. in. Bond developed between rubber and metal varies from 900 to 1550 lb. per sq. in. The United States Stoneware Co., Akron, Ohio.

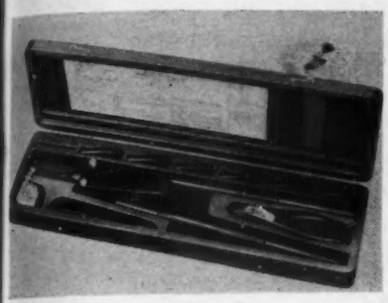
Synchronous Motors

Line of vertical high-speed hollow-shaft synchronous motors is furnished in ratings from 100 to 1000 horsepower and in speeds from 514 to 1800 r. p. m. Recommended for pumping applications where a large volume of fluid is handled, the motors are furnished in solid-shaft construction or with non-reverse ratchets to prevent reversal of pump rotation at shutdown or on starting. Have drip-proof inclosures and sturdy cast-

iron frames. The top cover of the motor is removable for adjustment of the pump shaft, and easy access to the brushes and collector rings is obtained by unlatching a flush-mounted steel plate. General Electric Co., Schenectady.

Rivet Gun Kit

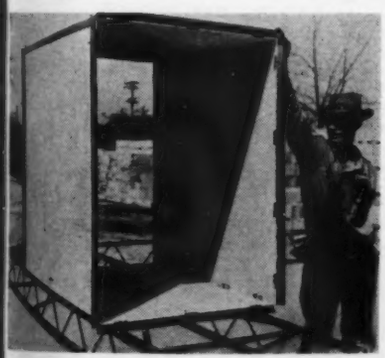
To aid field service and repair men in heading up blind rivets, rivet gun kit includes a G-10 hand gun which permits servicing operations where air power is not available. Has a complete complement of pulling heads and other accessories for



the hand gun. Six interchangeable pulling heads are included for sizes $\frac{1}{8}$-, $\frac{5}{32}$-, and $\frac{3}{16}$-in. standard diameter rivets, one each for countersunk and brazier type heads in all sizes. The kit also contains right-angle adapter for use in inaccessible places. Case measures $23\frac{1}{2}$x$7\frac{1}{4}$x$2\frac{5}{16}$ inches. Cherry Rivet Co., 239 Winston St., Los Angeles.

Panel Connectors

Lumm panel connectors are an engineered method for assembling non-metallic ducts for heating and ventilation, and to meet requirements for non-corrosive ductwork. The basic frame members come in various gages of metal, depending on the perimeter



of the duct required. Panels are slipped into place, secured by clips placed on 12-in. centers and shaped to permit the panels to fit snugly between them and the member. Special shapes can be made to meet unusual requirements such as double ducts and access doors. Distributed by Dravo Corp., 300 Penn Ave., Pittsburgh.

Shellac Substitute

Produced as a war emergency replacement, V-Lac looks like pure white shellac. Easy to apply with brush, cloth, or spray, high-gloss V-Lac is claimed more durable and water-resistant than shellac, and will not

HERE'S another plant conversion in which A-F Conveyor Engineers cooperated with a deep feeling of pride and achievement.

To convey the component cartridge parts in tote boxes to remote restricted areas, an A-F Overhead Conveyor System, over 12,000 feet in length, was installed. A similar, but shorter, A-F Conveyor System also conveys cartridge links.

This "Scientifically Planned" A-F Overhead Conveyor System frees valuable floor space and aisleways for other purposes, while constantly supplying employees with parts "from the air" in an endless stream.

Equipped with 7 synchronized caterpillar drives, such a conveyor system can be increased to almost indefinite lengths by adding additional drives, all operated from a central station.

BEFORE YOUR PLANT CONVERTS BACK TO PEACE-TIME PRODUCTION - *Write A-F*

Since 1901, our engineers have helped hundreds of leading plants to convert to war, then back to the production of their regular or new peace-time lines. Let us help you obtain peak post-war production quickly and efficiently with an A-F Scientifically Planned Conveyor System and A-F Metal Products Cleaning and Finishing Equipment. Write today.

THE ALVEY-FERGUSON COMPANY 137 Disney Street, Cincinnati 9, Ohio

CONVEYING EQUIPMENT

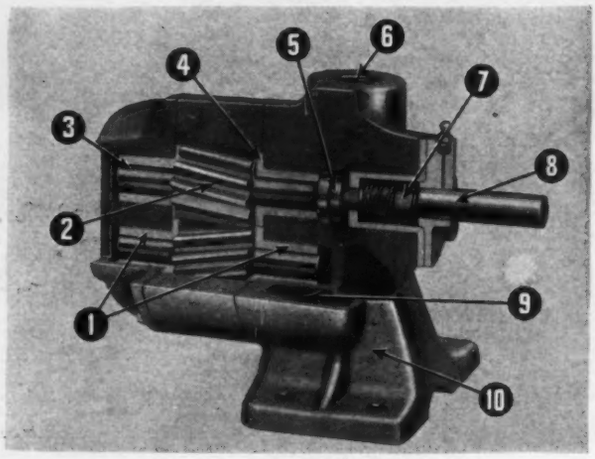
A-F CONVEYING MACHINERY

Alvey-Ferguson

METAL PRODUCTS CLEANING & FINISHING EQUIPMENT

NOTE THESE FACTS BEFORE YOU BUY ANOTHER PUMP

Ten Reasons for Choosing ROPER



1. LARGE BRONZE BEARINGS — two on each side.
2. SPIRAL PUMPING GEARS — Perfectly machined and run-in.
3. CONSTANT LUBRICATION — (1) by liquid being pumped and (2) by lubricating qualities of the bearing metal used.
4. WEAR PLATES protect face and back plates from wear by foreign matter.
5. THRUST COLLAR on drive shaft plus sliding joint takes up shock and thrust.
6. FOUR PIPE OPENINGS provide eight different piping arrangements.
7. MECHANICAL SEAL reduces power requirements and keeps leakage to minimum.
8. SPLINED DRIVE SHAFT forms sliding joint with gear to absorb shock and thrust.
9. ALWAYS PRIMED — after once primed and in operation.
10. ONE PIECE BACKPLATE protects working parts from stress and strain.

Simplest Principle Ever Designed...Only 2 Moving Parts

Equal size pumping gears operating at the same speed. Roper Hydraulically Balanced Pumps, quiet and smooth in operation, last longer with less servicing because of their simplicity and because internal pressure is equalized at all points.

ENGINEERING SERVICE

Roper Sales and Engineering Service reaches from coast to coast. All representatives have a thorough knowledge of engineering and a wealth of practical experience. Their services are promptly available to help you solve your pumping problems.

Write for Catalog
No. 938

With many illustrations, cut-away views, drawings, dimension and pumping capacity tables and complete information on Roper Pumps.

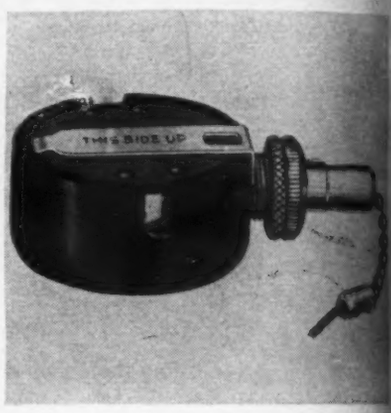
GEO. D. ROPER CORP., ROCKFORD, ILL.

ROPER *Rotary* PUMPS

turn white. Has no offensive odor, and can be thinned with benzine, mineral spirits, or turpentine. Drying time is two hours. According to the maker, floors painted with this product can be sanded without gumming. 20th Century Paint & Varnish Co., 30 Roebling St., Brooklyn.

Levolier Switch

Plastic shell levolier switch No. 1010 has been redesigned with a plastic casing in place of the former brass shell. Additional saving in critical metal is also effected



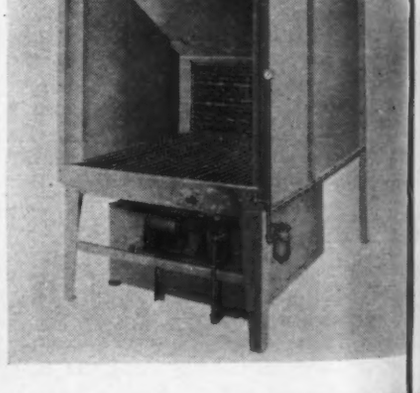
through the use of plastic material in the fabrication of a frame to which the top and bottom disks are secured. The front member of the frame is threaded to take the mounting unit. McGill Mfg. Co., Inc., Valparaiso, Ind.

Corporation

McKenna Metals Company, Latrobe, Pa., manufacturers of Kennametal products has been succeeded by Kennametal Inc., a corporation of Pennsylvania. The personnel, management, products, and policies remain the same.

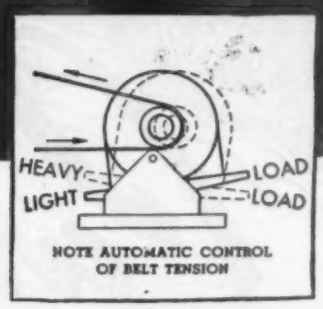
Spray-Degreasing Booth

Advantage claimed for this spray-degreasing booth is ability to hold solvent loss to barest minimum. Engineered for safe operation where hazardous materials of high volatility and low flashpoint are used, the unit is designed to remove fumes thoroughly and to deliver a forceful solvent



Belt Life QUADRUPLED

through a $51.70 investment . . .



NOTE AUTOMATIC CONTROL OF BELT TENSION

● The rubber V-belts shown above were condemned as unfit over four years ago . . . yet they are running in good condition today! What's the answer?

This manufacturer had belt-stretch trouble from the moment he installed this big 12 x 11 air compressor. Monthly belt adjustments were necessary. No belts lasted over a year.

In '39, instead of buying a new set of belts, he installed an *American Econ-o-matic Drive* . . . putting on the same old set of "condemned" belts. This same old set of belts has been driving the compressor ever since without a bit of attention! No more monthly belt take-ups needed. No more shutdowns due to maintenance. With a drive investment of $51.70, this manufacturer has already saved over $400 in belt costs alone!

The load governs belt tension with an American Econ-o-matic Drive!

Here is the heart of the Econ-o-matic Drive—the American Econ-o-matic Motor Base. It *automatically* and *instantly* matches belt tension to each variation in the load on the motor. When load is heavy, belt is automatically tightened. When load is light, belt is automatically loosened. There's never more tension on the belt than the load requires. No slide rails or idlers to adjust! Whether Short-Center Flat-belt or V-belt type—American Econ-o-matic Drives give you these advantages:

- Longer life for belts and bearings
- No belt slip—no lost R.P.M.
- Maintenance man-hours greatly reduced
- Smooth, cushioned starting
- Increased machine output
- Substantial power savings

Navy "E" for excellence awarded Feb. 12, 1942.

Send for this new Econ-o-matic Handbook

It gives you complete drive data, solves drive maintenance problems and shows how to select the right drive for your purpose. Write now.

The American Pulley Company
4202 WISSAHICKON AVE., PHILADELPHIA, PA.

OVAL BAG DUST ARRESTORS

"A Good Dusting in more Ways than One"

It is a proven fact that clean air in a plant makes an immediate "about face" in production, absenteeism and maintenance costs. In 99 cases out of 100 production and efficiency goes up while maintenance goes down. On a strictly dollar and cents basis Parsons modern Oval Bag dust arrestors pay for themselves in no time because they speed up production, protect and prolong the life of employees, equipment and buildings and pay dividends for years to come. Parsons exclusive features include unique patented Oval Filtering Bags, Non-rusting Arrestor Case, Simple Texrope Drive, Heavy Duty Welded Hoppers.

Modern Dust control by Parsons Ovals means healthier and more profitable business, peak production, less breakdowns, fewer layoffs.

Send for our free bulletin.

PARSONS ENGINEERING CORP.

2545 EAST 79th STREET

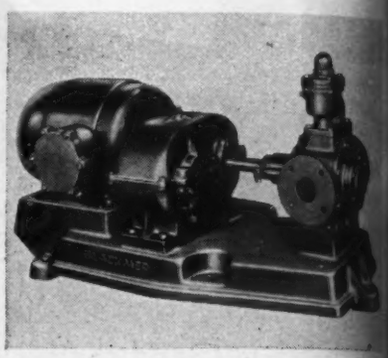
CLEVELAND

OHIO

spray. The booth is made in 14-, 16- and 18-gage steel. Sizes vary according to the requirements of products to be handled. The DeVilbiss Co., Toledo.

Rotary Pumps

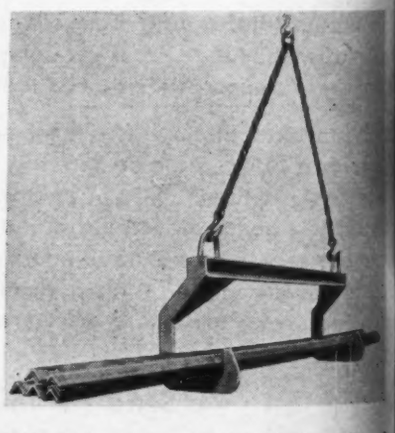
Series of rotary pumps with antifriction bearings is available for general industrial use. Bearing design is claimed to reduce power requirements and permit higher operating pressures. Because bearings are in contact with the liquid being pumped,



units are recommended only for handling viscous liquids or non-viscous liquids having lubricating properties such as oils, syrups, molasses. Capacities range from 10 to 750 g.p.m. at pressures up to 150 psi. The pumps are available in all-iron or in bronze-fitted constructions, with steam-jacketed heads, with or without removable liners, and in all standard drives, including gearhead motor. Blackmer Pump Co., Grand Rapids 9, Mich.

Bar Stock Sling

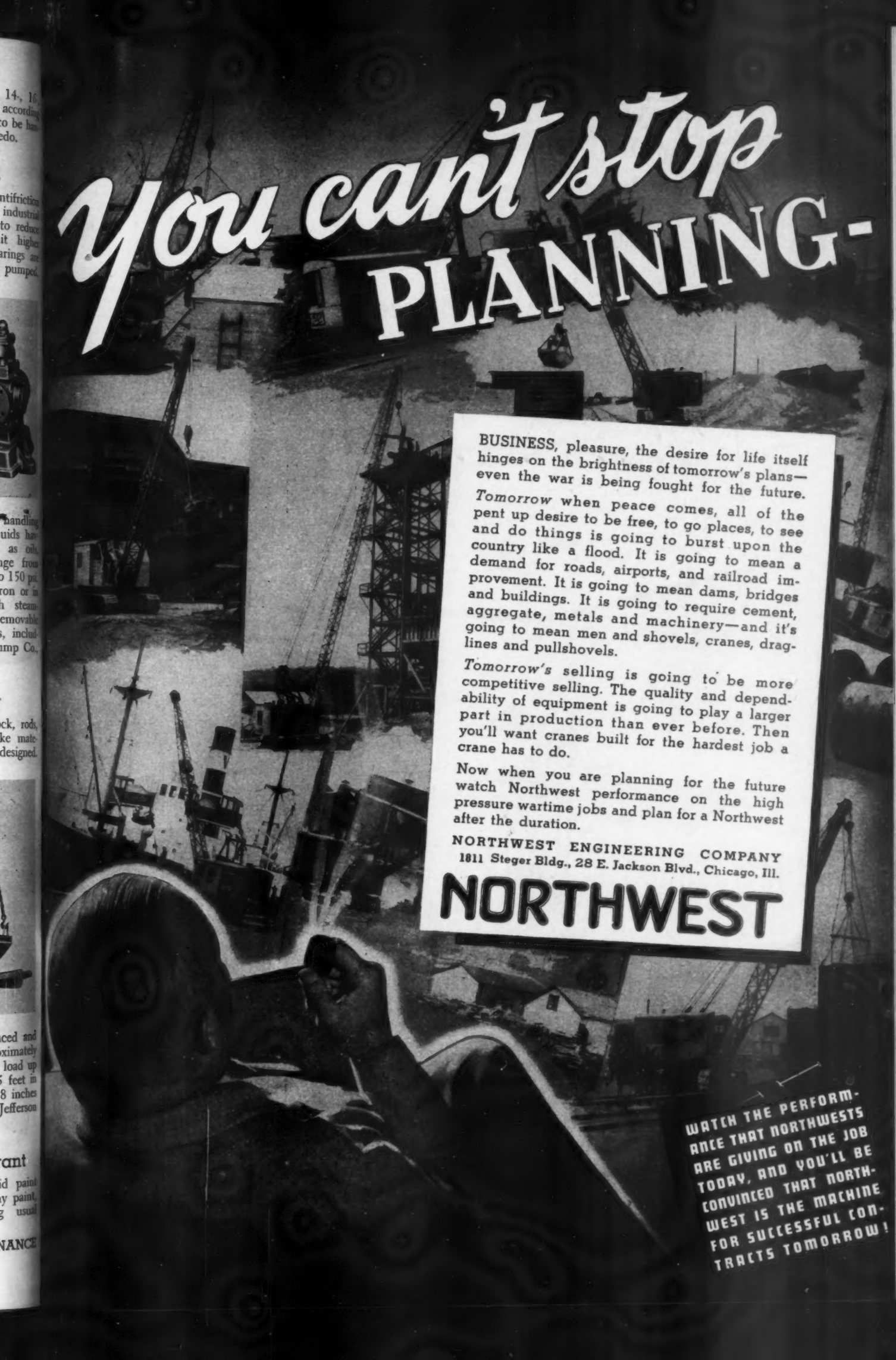
To facilitate handling of bar stock, rods, angle iron, heavy tubing, and like materials, a bar stock sling has been designed.



Built of heavy stock, strongly braced and reinforced, and weighing approximately 50 pounds, the sling handles any load up to 2000 pounds. Sling measures 5 feet in length. Cradle is 10 inches wide, 8 inches high. Palmer-Shile Co., 7110 W. Jefferson Ave., Detroit.

Liquid Paint Deodorant

Small quantity of Ridsmel, liquid paint deodorant, may be mixed with any paint, varnish, or enamel, eliminating usual


You can't stop
PLANNING-
BUSINESS, pleasure, the desire for life itself hinges on the brightness of tomorrow's plans—even the war is being fought for the future.
Tomorrow when peace comes, all of the pent up desire to be free, to go places, to see and do things is going to burst upon the country like a flood. It is going to mean a demand for roads, airports, and railroad improvement. It is going to mean dams, bridges and buildings. It is going to require cement, aggregate, metals and machinery—and it's going to mean men and shovels, cranes, draglines and pullshovels.
Tomorrow's selling is going to be more competitive selling. The quality and dependability of equipment is going to play a larger part in production than ever before. Then you'll want cranes built for the hardest job a crane has to do.
Now when you are planning for the future watch Northwest performance on the high pressure wartime jobs and plan for a Northwest after the duration.
NORTHWEST ENGINEERING COMPANY
1811 Steger Bldg., 28 E. Jackson Blvd., Chicago, Ill.
NORTHWEST
WATCH THE PERFORMANCE THAT NORTHWESTS ARE GIVING ON THE JOB TODAY, AND YOU'LL BE CONVINCED THAT NORTHWEST IS THE MACHINE FOR SUCCESSFUL CONTRACTS TOMORROW!

MAN BURIED ALIVE IN COAL CHUTE
The life of [redacted] was miraculously saved when he was buried under five feet of coal for several hours in a hopper at the power pla[redacted]
He had been attempting to break up the bridging or arching of coal in one of the bunkers leading to the mechanical stokers. Contrary to safety regulations, he had gone onto the top of the coal surface without first having a rope, with a second man on the catwalk to attend the line.

It can't happen here!

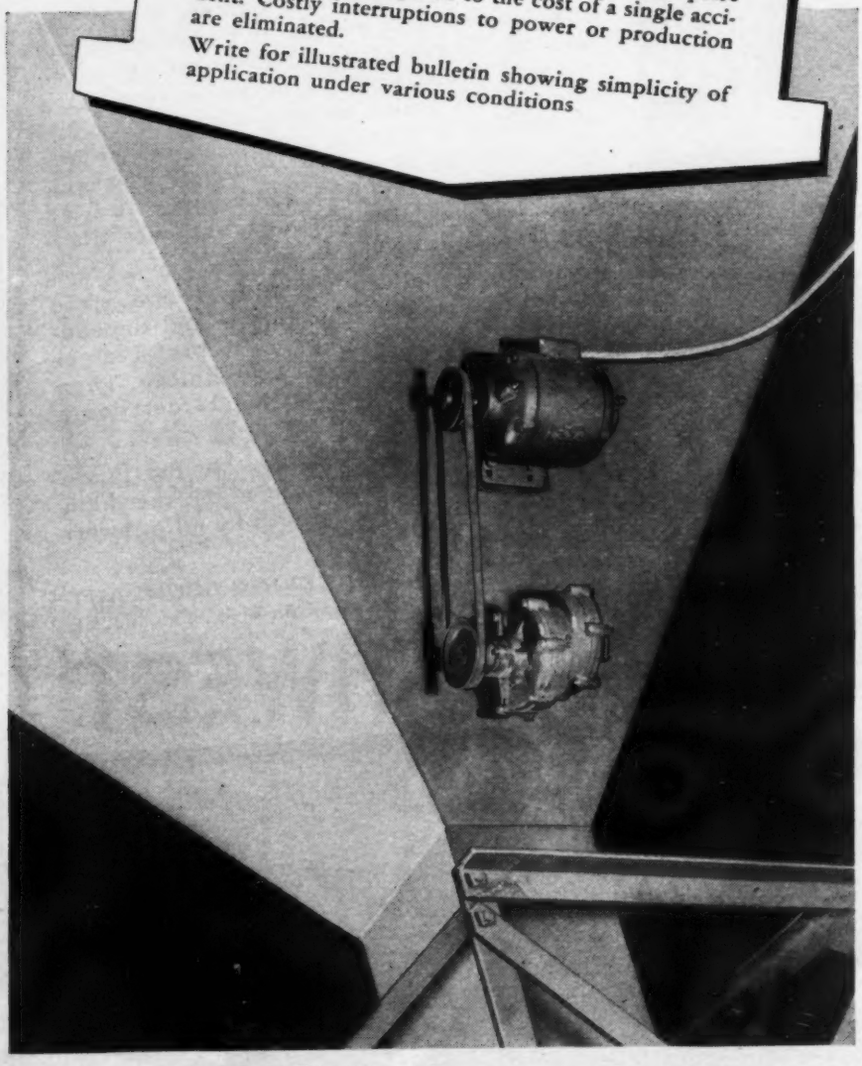
AJAX SHAKER PREVENTS BRIDGING

- Application of vibration to the side of hopper carrying bulk materials to constricted outlet eliminates hazardous bridging or arching.

The angle of slide is maintained, thus eliminating flow stoppage due to compacting of material at narrow outlet of hopper.

Application of Ajax Shakers provides safety at a price which is trivial compared to the cost of a single accident. Costly interruptions to power or production are eliminated.

Write for illustrated bulletin showing simplicity of application under various conditions



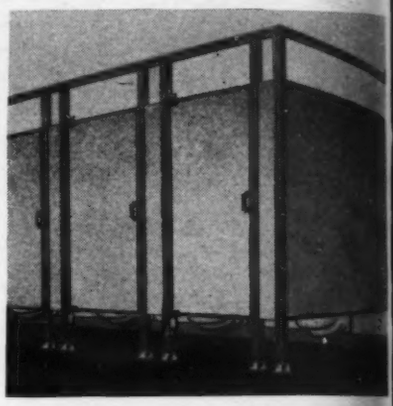
AJAX FLEXIBLE COUPLING CO.

Incorporated 1920 **WESTFIELD, N. Y.**

odors completely, according to the maker. Ridsmel is claimed not to affect color, drying, or durability of finishes; and one quart of the solution will effectively neutralize 200 gallons of paint, varnish, or enamel. Equally effective with brush or spray operation. Holley Chemical Co., 125 E. 25th St., New York.

Toilet Compartments

Compartments feature doors and partitions of two sheets of cement asbestos board laminated to a structural core. This provides a strong, rigid partition panel

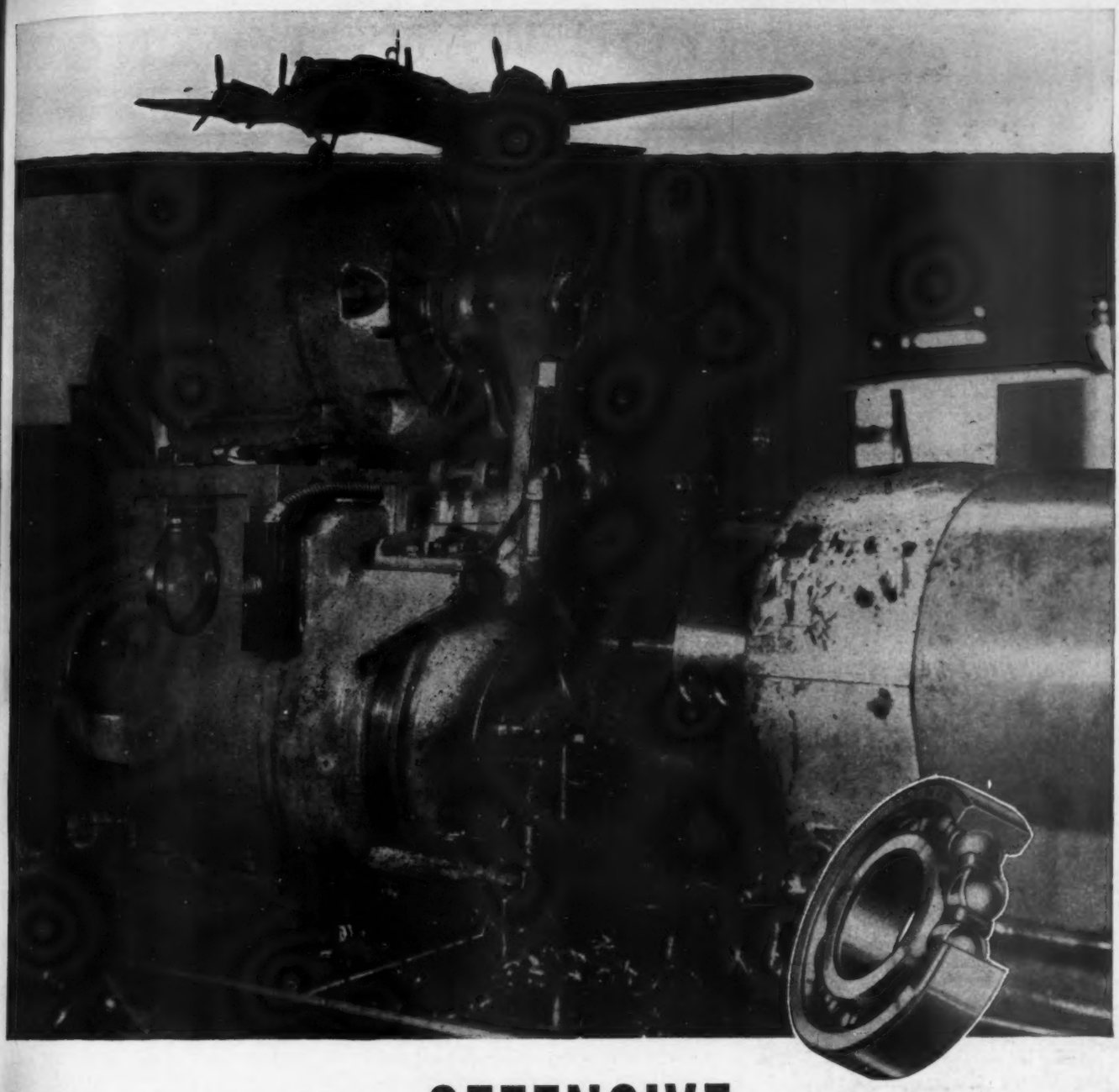


that is claimed moisture-, fire-, and wear-resistant. Comes in two types. One is known as the Duration type; the other, in which steel posts and headrail bracing are used, is known as Sanybestos. Sanymetal Products Co., Inc., 1677 Urbana Rd., Cleveland.

Inspection Instruments

Two-tube fluorescent daylighted magnifying instruments with 5-in. lens are built as floor models. The base is equipped with four two-wheeled (wood wheels) castors for portability. Model 1234-W5F

is a single lens instrument; Model 1234-W55F is a double lens instrument. Mounting permits quick, easy adjustment of the head in all directions. Instruments are furnished in maroon or all white, and are shipped complete, ready to plug in for use. Tempered glass face to keep oil and grit off lens and tubes is optional. Larrimore Sales Co., P. O. Box 1234, St. Louis, 1.



Around-the-Clock **OFFENSIVE** in Connecticut!

Whether in Connecticut, Kansas or California the machines of industry are waging an all-out, ceaseless war against TIME. They're battering every elusive hour into complete subjection . . . getting the utmost out of every minute's production. Many of these machines never slow down. Their "time" isn't divided into shifts and days . . . it's the *job* that counts!

Ball Bearings keep these machines off the casualty lists. Ball Bearings provide the high-speed efficiencies, the positive freedom from friction and maintenance trouble that assures their steady production-march. Here, as on the battlefronts, Ball Bearings are literally *ammunition.* In the rudder assembly of a bomber, or on the spindle of a high-speed grinder . . . they *can't* fail! The Fafnir Bearing Company, New Britain, Conn.

ARMY (E) NAVY

FAFNIR

BALL BEARINGS

BD-72

● Military authorities doubt that the war will be won by any secret super weapon. They count on fighting efficiency developed out of many small things—advantages gained from foresight and painstaking attention to detail.

For example, take the BD-72 portable military switchboard developed at *Connecticut,* in cooperation with Signal Corps engineers. It has many features we can't tell you about, but we can say that the BD-72 was designed to save space, to get into operation faster, to stand a lot of rough usage under fighting conditions. Small things? Not if its small size permitted getting one more machine gun aboard the truck. Not if it helps "get the message thru" even *seconds* sooner. Small things sometimes loom large when the job is to get the jump on the enemy.

All over America, the doom of the Axis is being made more and more certain by giving the fighting men of the United Nations better fighting tools. The birth of better ways of doing things *after* the war, is an all-important by-product of this effort. *Connecticut Telephone & Electric* is an excellent source of ideas for developing your postwar product or manufacturing methods, if they involve communications, or the engineering and manufacture of precision electrical devices.

ARMY E NAVY

CONNECTICUT TELEPHONE & ELECTRIC DIVISION

GREAT AMERICAN INDUSTRIES INC.

MERIDEN, CONNECTICUT

© 1943 G.A.I., Inc., Meriden, Conn.

YOU WANT TO KNOW

more about the items mentioned on this page

Letters to the addresses given will bring information

● "LABOR-MANAGEMENT NEWS" is to be published weekly for circulation among members of Labor-Management Committees. A periodical clearing house of information on war production in general, and labor-management committees in particular, the paper will serve also as a source publication for the press and other media. Official publication of the War Production Drive, inquiries about the paper may be directed to Committee Materials Branch, War Production Drive Headquarters, Washington, D. C.

"EYE SAVERS," all-plastic, featherweight safety goggles, fit directly over prescription glasses, and the full frame gives added protection against injury from sides, top, and bottom. Frame is strongly reinforced with metal clip at bridge, and is ventilated to prevent fogging. The shatterproof lenses can be easily removed for cleaning or replacement. Snap-in filters are available for torch-welding or cutting, and other glares. Watchemoket Optical Co., Providence, R. I.

● PRODUCTION planning process has been worked out by Arko, Inc., 403 W. Eighth St., Los Angeles 14, to speed up estimating, planning, and scheduling any type of manufacturing job. According to the originators, flexibility of the process makes it applicable to any sorting or classifying method, manually or mechanically operated. It is automatic in its findings.

● "RECREATION—A Resource of War" is a valuable bit of information prepared in pamphlet form to help communities in war areas meet off-the-job needs of war workers and their families. Gives management and labor, churches, and public and private civic organizations a basic outline for planning recreational activities. Copies are available from Division of Recreation, Federal Security Agency, Social Security Bldg., Washington 25, D. C.

● WRAPPING PAPER V-26 has two-in-one qualities. The inner ply provides a grease-proof barrier for retaining the corrosion preventive used on metal products; the strong outer ply protects the grease-proof membrane against damage in transit. Of neutral kraft, the paper is creped for flexibility in wrapping, with a dead limp folding quality. Available either with outer film of wax which provides a self-sealing surface, or in uncoated form. Sherman Paper Products Corp., Newton Upper Falls, Mass.

● MOTION PICTURE to combat absenteeism caused by improper nutrition shows how housewives serving health-building meals safeguard their family's physical fitness and cut down accidents caused by fatigue. Easy way to insure balanced diets in spite of rationing is shown. Filmed at the RKO-Pathe studios in Hollywood, "This Too Is Sabotage" features a cast of motion picture actors. Showing time is 25 minutes. Both 16 and 35 mm. prints are available on request from Visual Education Section, Westinghouse Electric & Mfg. Co., Mansfield, Ohio.

● "WOMEN in Winchester" is an attractive booklet put out by Winchester Repeating Arms Co., New Haven, Conn., to interest women in jobs at Winchester and to make them feel welcome there. Made available to prospective employees through coupon advertisements in local newspapers, the booklet shows actual photographs of women at work in Winchester. Illustrations of the variety of jobs available and a resume of facilities and advantages offered employees give the outsider a brief picture of Winchester's workaday policies.

● FIVE POSTERS on women in war production may be ordered from Superintendent of Documents, Government Printing Office, Washington, D. C. Titles are "Women of All Ages Work on War Jobs," "Women's Hands Speed War Production," "Women Answer Manpower Shortages," "Scientifically Trained Women in War Jobs," and "Work Clothes for Safety and Efficiency." The posters include 46 photographs of women workers on various processes in key industries, with emphasis on safety standards. Size is 30x40 inches. Price is 10c a poster, 50c a set.

● "AUTOMOBILE MAINTENANCE" is discussed in Booklet 3 of the series on war plant employee transportation being published by National Association of Manufacturers and National Conserva-

Putting the Pressure on Cartridge Production

SOLNUS HYDRAULIC OILS

On the job 8760 hours . . . Still good for many more!

If you are running your hydraulically operated equipment on a "round-the-clock schedule" here are facts on hydraulic oils you should consider.

In a large cartridge-making plant three lines of hydraulic presses were drawing the brass cases from cups to finished size on a 24-hour a day schedule. In each of these presses a different oil was used—Solnus Hydraulic Oil, a competitive oil of equal price and another costing considerably more.

After all three had been in continuous operation for 8760 hours at pressures up to 2500 pounds per square inch samples were taken of each and tested for all the essential characteristics. The results?

Solnus Hydraulic Oils were in practically new condition ready for many more hours of extra service, while the other oils showed a deterioration to such a degree that they were ready to be changed.

This is only one of the many instances in which Solnus Hydraulic Oils have demonstrated their long life and ability to stand up under pressure. If you want to improve the operation of your hydraulic system call in a Sun specialist—one of those Doctors of Industry. He's ready, willing, and able to help you keep your production on a round-the-clock schedule. Write . . .

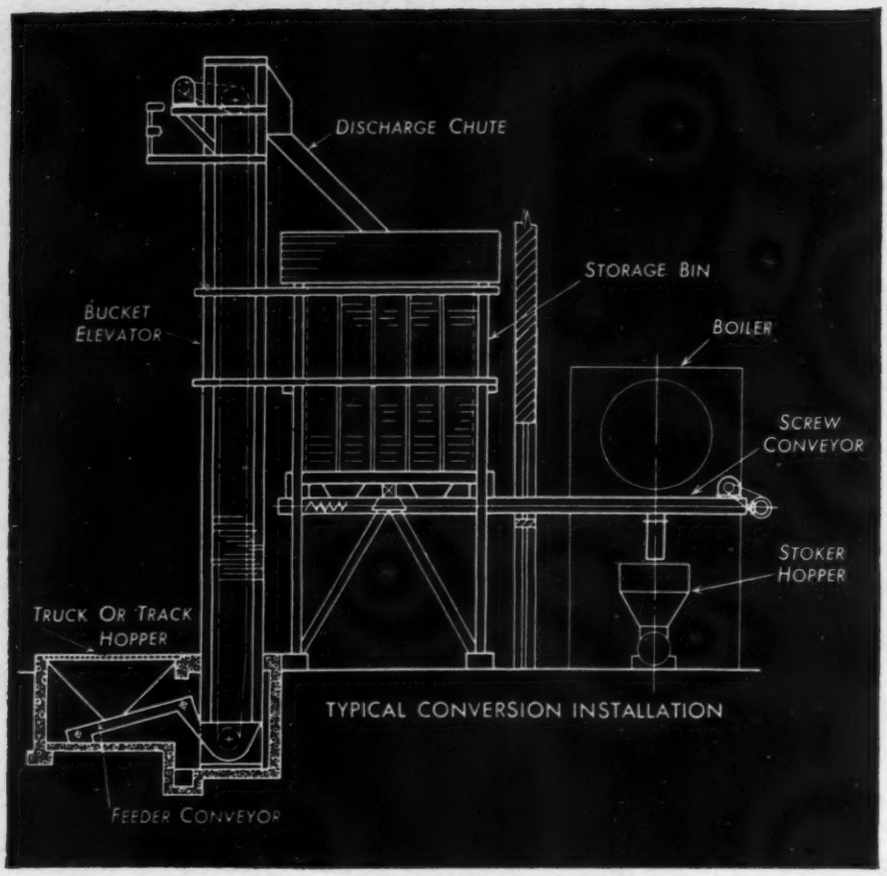
SUN OIL COMPANY, *Philadelphia*

Sun Oil Company, Limited, Toronto, Canada

SUNOCO

SUN PETROLEUM PRODUCTS *HELPING INDUSTRY HELP AMERICA*

NOT MUCH TIME LEFT
FOR CONVERSION TO COAL



TYPICAL CONVERSION INSTALLATION

Every indication points to continued shortages of fuel oil supplies for industrial plants. You'll feel safer with coal. The quick, efficient, economical way to convert your plant from oil to coal is to let Gifford-Wood do it for you. Hundreds of G-W coal and ash handling installations are helping to keep up industry's steam requirements. They'll serve for many a year after the war is over. Let G-W lay on your desk a complete plan and proposal.

For a quick appraisal of Gifford-Wood equipment write for Catalog No. F—mostly pictures, drawings, tables and engineering data. Free on request. Please use your business stationery.

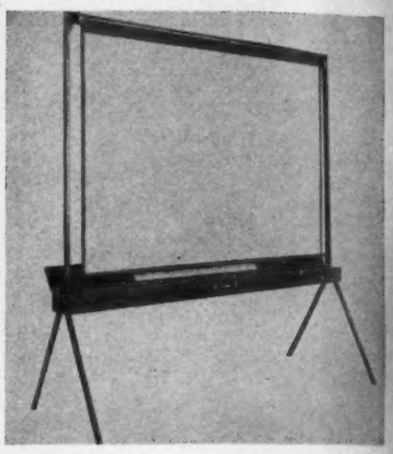
GIFFORD-WOOD CO.

FOUNDED 1814

420 Lexington Avenue, New York — **HUDSON, N. Y.** — 565 W. Washington Street, Chicago

Ash Spouts • Barge Unloading • Bins • Boiler House Equipment • Buckets • Bunkers • Carriers • Chutes
Conveyors • Crushers • Elevators • Feeders • Gates • Ground Storage Systems • Hoists • Hoppers
Infra-Red Drying Systems • Screens • Silo Storage Plants • Tanks • Weigh Larries

tion Bureau. The booklet answers 21 such significant questions as "What are the principal items the plant should stress in promoting car conservation?" "What are the facts on the rubber situation?" "What are some of the items of proper automobile care that should be included in an educational campaign?" Copies are available from National Association of Manufacturers, 14 W. 49th St., New York.



PROJECTION SCREENS made of non-critical materials come in portable, table, wall, and ceiling models in a variety of sizes. The screen has Hyflect glass-beaded surface. Line includes sizes from 22x30 inches to 16x16 feet. Radiant Mfg. Co., 1140-46 W. Superior St., Chicago

• "EMPLOYEE RETIREMENT Plans" is a 60-page summary of the latest thinking of pension planners and managers. Full text of the Treasury Department's new regulations covering allowable corporate income tax deductions for contributions to employee pension funds, as issued July 8, is included. Copies may be had at 35c each from the N. Y. Journal of Commerce, 63 Park Row, New York.

• "HOW INDUSTRY Can Cooperate with the U. S. Government Information Program to Reduce Absenteeism" is a booklet prepared by The War Advertising Council, 60 E. 42nd St., New York, listing the causes of absenteeism and the cures. It gives suggestions and information to guide advertising and promotion material written on the subject.

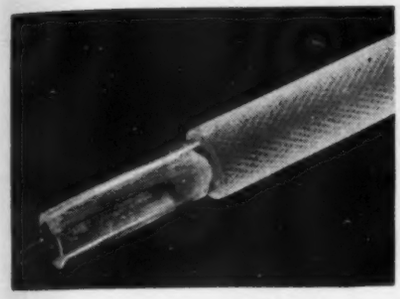
• WALT DISNEY POSTERS promoting better eating habits for war workers are available for distribution through George Rice & Sons, 320 Crocker St., Los Angeles. They were made through the efforts of the Food and Nutrition Committee, California War Council, to aid in the national Nutrition in Industry program.

• "OFF THE JOB Accidents—The Relation of Light to Safety" is a fact book prepared by the Lamp Department, General Electric Co., Schenectady, to help educate workers in safety. Because the "dimmer the light, the greater the danger,"

this booklet gives words of caution on how to meet the wartime dimout safely.

• BELT LENGTH CALCULATOR accurately determines belt length with two simple settings of a slide, cutting down lengthy mathematical calculation. Handy pocket-size, the measure is available from J. E. Rhoads & Sons, 35 N. Sixth St., Philadelphia.

• INSULATING and weatherstripping tape of pliable plastic is pressed into place with the fingers. According to the manufacturer, J. W. Mortell Co., Kankakee, Ill., the tape does not chip, crack, or dry out, and can be removed for re-use the next season. Is also recommended for glazing and calking, for gaskets, for plugging cracks. Comes in 80-ft. coils.



WRENCH made of lightweight Plexiglas and designed for assembly operations on radio equipment used by the U. S. Navy Bureau of Ships has been developed by Wells-Gardner Co., Chicago, and Klise Mfg. Co., Grand Rapids, Mich. The wrench has high dielectric strength, is durable and weather-resistant

• "PLANNING MEALS for Industrial Workers," second in a series of publications issued by the Nutrition in Industry Div., War Food Administration, Washington 25, D. C., contains many suggestions for cafeteria, canteen, and lunch box meals and between-meal snacks.

• "PRACTICAL Design for Arc Welding" is a new design and suggestion service in leaflet form for executives interested in "reconstruction problems" in production, processing, construction, and maintenance of equipment during and after the war. Offered free by The Hobart Brothers Co., Hobart Square, Troy, Ohio, the plates are prepared by Robert E. Kinkhead, well-known welding consultant. First set of sheets has such plate titles as Light Machinery Base Corners, Taper Cantilever Beams, Platforms, Machinery Frame and Bearing Blocks.

• "GOOD INDUSTRIAL Relations" suggests a few rules to follow in promoting better industrial relations policies. The four sections of the booklet are titled "Industrial Peace Promotes Industrial Prosperity," "Good Industrial Relations Are Good Business," "Some Underlying Facts," and "Fundamental Principles." Formulated by National Association of Manufacturers, 14 W. 49th St., New York.

Today - as in 1918...

BLAW-KNOX BUILDINGS HAVE GONE TO WAR!

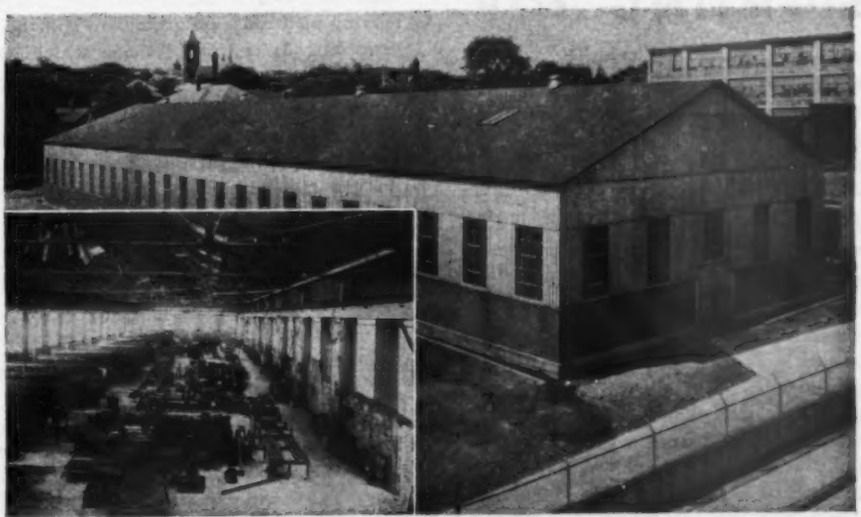
All types of Blaw-Knox Standard Steel Buildings are now serving the armed forces in many parts of the world.

Today—they are helping the war program by providing permanent, weather-tight, firesafe structures for warehouses, airplane hangars, shops, utilities and other specialized military uses.

Tomorrow—after the war, Blaw-Knox will offer an adequate building to economically meet any requirement or application.

Enlist Blaw-Knox help in Your Building Problems

Enlist Blaw-Knox help in solving your building problems right now, provided you are doing war work and steel can be allotted for the purpose.



Interior—note open, unencumbered space. Size and shape of buildings to suit your needs.

BLAW-KNOX STANDARD STEEL BUILDINGS
BLAW-KNOX DIVISION of Blaw-Knox Company
FARMERS BANK BUILDING, PITTSBURGH, PENNSYLVANIA

"This is a Grinding War . . ."

Copyright 1892 and 1920 by Harper & Bros.

FIGHTING TOP-

A terror in its day was the Gatling gun, shown here in the fighting top of an 1892 battleship. It was good as guns went then, when there was no such thing as production grinding, but modern weapons leave it far behind.

How did our fighting equipment make such progress in so few years.

Give a pat on the back to those who dreamed up the new designs—and to the far-seeing men who spark-plugged research in years of peace as well as war. Much credit, however, for the development of our precision ordnance must go to American mass production methods. But without grinding methods and processes, mass production as we know it could not exist.

Take the modern anti-aircraft gun. Every moving part must be ground to split-hair precision. It is this precision which enables the gun to fire with such deadly accuracy, so rapidly and so continuously.

And this goes for every other piece of fighting equipment, too. Every moving part in the engines which carry a plane, tank, truck, jeep, sub or ship into battle must be ground to closest tolerances.

Grinding is on the job even before production of these weapons begins.

The cutters, reamers, drills and broaches of machine tools that *make* machines of war must also be ground to close limits.

Carborundum has helped to develop many modern grinding processes in the past. And today, because "this is a grinding war," our engineers, research men—*all* of the men and women of Carborundum are working with redoubled energy.

Their contribution to the war effort received official recognition when the men and women of Carborundum were recently awarded the Army-Navy "E" Production Award. And they stand ready to make a similar contribution toward a better world of peace.

* * *

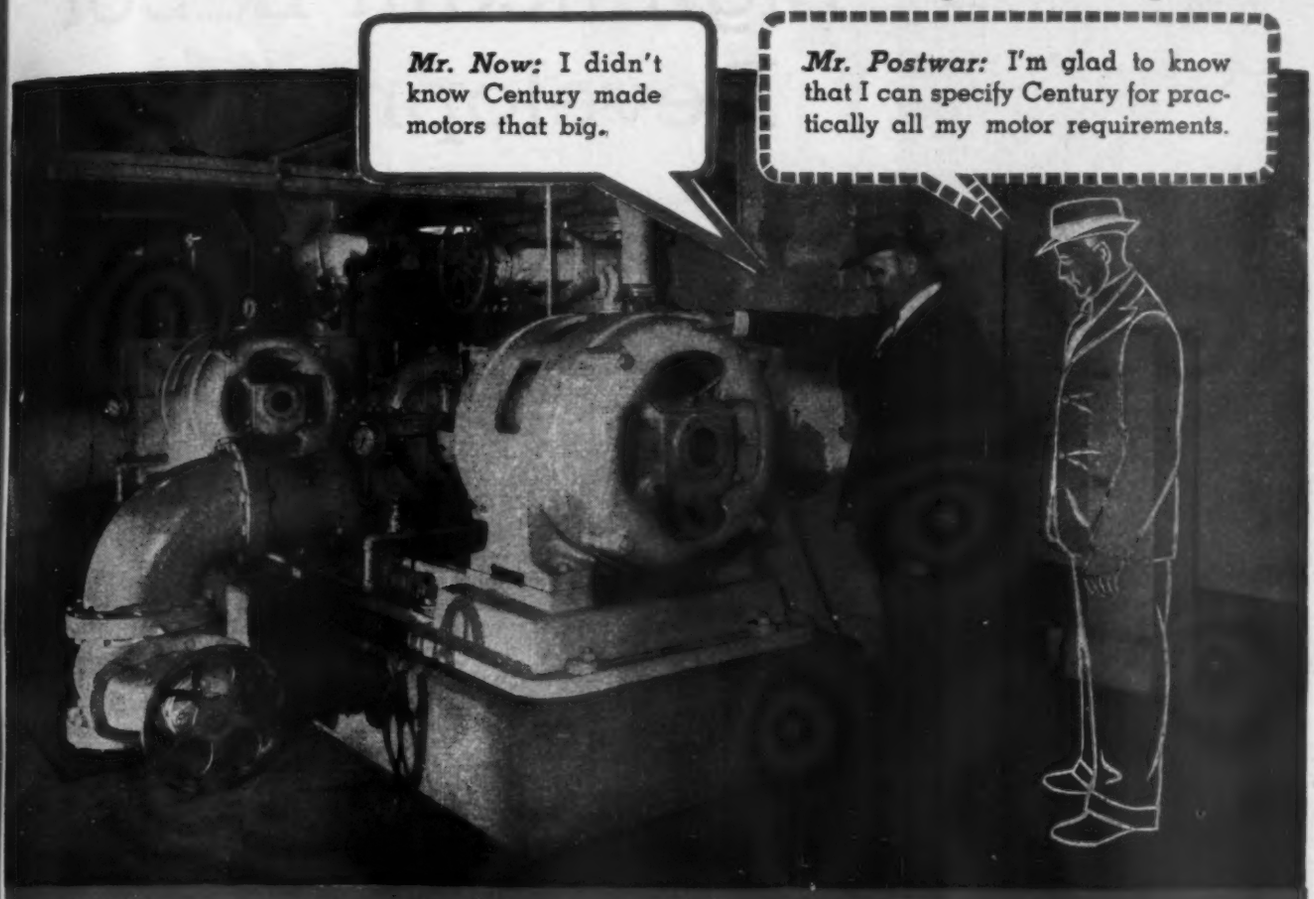
Every hour this war is shortened will save $12,000,000. The lives it will save are priceless. So please remember that grinding wheels, too, are "Weapons for Production" . . . use them wisely to help end the war sooner.

The Carborundum Company, Niagara Falls, New York.

THE CARBORUNDUM COMPANY

CARBORUNDUM AND ALOXITE ARE REGISTERED TRADE-MARKS OF AND INDICATE MANUFACTURE BY THE CARBORUNDUM COMPANY

Take a Look at TOMORROW – *Today!*


Mr. Now: I didn't know Century made motors that big.
Mr. Postwar: I'm glad to know that I can specify Century for practically all my motor requirements.

CENTURY BUILDS *BIG MOTORS Too!*

1/6 TO 600 H.P.

Century Motors are available that not only accurately match the demands of the load, but also provide for proper protection against surrounding operating and atmospheric conditions.

There's a real advantage—now and in the future—in the fact that Century Motors are built in a wide range of types and sizes, from fractional horsepower up to and including 600 horsepower.

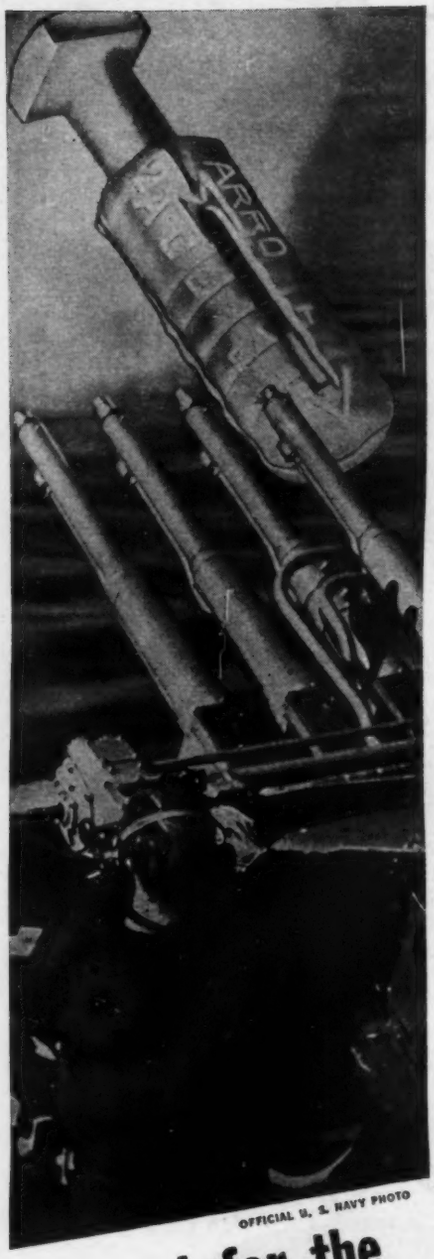
Today, under the rigid demands of Wartime production, Century is developing and building finer motors in an even wider variety of types and sizes than in over forty years of motor manufacturing.

If you have not received our new bulletin on polyphase motors, write for it now. Specify Century.

FORM J
← *NOW READY*
2 TO 15
H. P.

CENTURY ELECTRIC CO.
1806 Pine Street · St. Louis 3, Missouri
Offices and Stock Points in Principal Cities

Century MOTORS



OFFICIAL U. S. NAVY PHOTO

Reserved for the FIGHTING and WAR Production Fronts

TRADE ARRO MARK

EXPANSION BOLTS

AND ALLIED PRODUCTS

Sold only through jobbers

ARRO EXPANSION BOLT COMPANY
MARION, OHIO

Significant Labor Developments

Period Surveyed: July 10 to August 10

TREND INDICATORS

Job Transfer Rules

WMC, THROUGH ITS APPELLATE BOARD, promulgated the following rules to govern job changes:

1. Clearance for a new job will not be given if the employee has no *bona fide* offer of a new job; he may not be released to shop for higher-skilled employment.

2. An employee offered a higher-skilled job may not be retained by his present employer merely on the latter's word that the employee is not qualified for a superior job.

3. Substandard earnings constitute good ground for obtaining release from one essential job for another such job.

4. Commuting distance is not excessive so as to justify changing jobs if it is accomplished by a car-pooling arrangement.

Held Under the Wage-Hour Act

A company managing a loft building for its owner, as well as the owner, since the management company performed many services customarily performed by an owner managing his own building, hired the employees, paid them their wages for which it was reimbursed by the building owner, and directly supervised them in the performance of their duties. (Greenberg vs. Arsenal Building Corporation.)

Employees of a company engaged in the repair, maintenance, and reconstruction of public highways, except:

1. Drivers and operators of distributor trucks and tank trucks used to haul oil from the railroad to be applied to the highway, who are found to be under the jurisdiction of the Interstate Commerce Commission and exempt from the overtime provisions of the Act.

2. Gravel pit or "off the road" employees.

3. Shop mechanics during the "dead" season when no highway operations are in progress. (Walling vs. Craig)

Time

Work day under the Wage-Hour Act begins with checking in and ends with checking out. (Ruling of Wage-Hour Division.)

Authorized Change in Method of Pay

A Federal District Court ruled the Wage-Hour Act does not prevent an employer from changing his method of compensating employees where such change is a lawful one. The plan approved was one whereby employees who had been paid on a salary basis were shifted to an hourly basis, in accordance with a contract and a guarantee by the employer of sufficient overtime work paid for at time and one-half to make their earnings equal to what they had received as salary (Belo doctrine). (Walling vs. Malone & Hyde, Inc.)

Employer's Knowledge of Overtime

The Kansas Supreme Court ruled that before an employee may recover overtime pay for alleged overtime that he has been "suffered or permitted," the employee must show that the employer knew that the work was done on overtime; otherwise the employee may not recover for such overtime. (Jackson vs. Derby Oil Company)

Records

The Wage-Hour Administrator may require a company to produce for inspection and photographing records relating to wages, hours, and duties of employees, records kept in accordance with orders of the ICC, and receipts, settlements, compromises, releases of wage claims of employees.

Enforcement

For a deliberate failure to keep time records and to pay the required overtime and minimum wages, an Examiner of the Public Contracts Division recommended the imposition of the blacklist penalty even though its effect would be to deprive the women of the locality of their major source of employment.

Conspiracy Not Offense Against Civil Rights Statute

A conspiracy between employers and union officials to intimidate employees in the exercise of their rights to maintain actions to recover wages under the Wage-Hour law was held not to be an offense against civil rights of citizens. The conspiracy has no relationship to the rights of employees as citizens. The employees whose rights are secured by the Wage-Hour law need not be citizens, and an offense against that law, if duly established, neither adds nor subtracts from the rights which are possessed by the victims deriving from their status as citizens, assuming all of them to be such. (U. S. vs. Berke Cake Co., Inc.)

Contract Held Illegal

A Federal District Court held that a contract providing that an employer would

AMERICAN AIRLINES

PAA
PAN AMERICAN AIRWAYS

TWA
The TRANSCONTINENTAL Airline

UNITED AIR LINES

They're All Using It

Never before in the nation's history has air speed been so important—and never before has speed been so vital a factor in the maintenance of hangar floors. In speedily removing hazardous oil and grease from floors, the *Finnell Combination Scrubber* has proved *a valuable safety aid* to air transportation systems as well as to the war industries generally. And it has substantially reduced the man-hour time required—*to one-tenth and more in many cases!*

The *Finnell* illustrated, which requires just one operator for the scrubbing, rinsing, and drying operations, has a capacity of 8,750 sq. ft. of floor an hour. And there's a still greater-capacity *Finnell* for use in vast-area war production plants.

For free floor survey, consultation, or literature, phone or write nearest *Finnell* branch or Finnell System, Inc., 2509 East Street, Elkhart, Indiana.

THE *Finnell* COMBINATION SCRUBBER

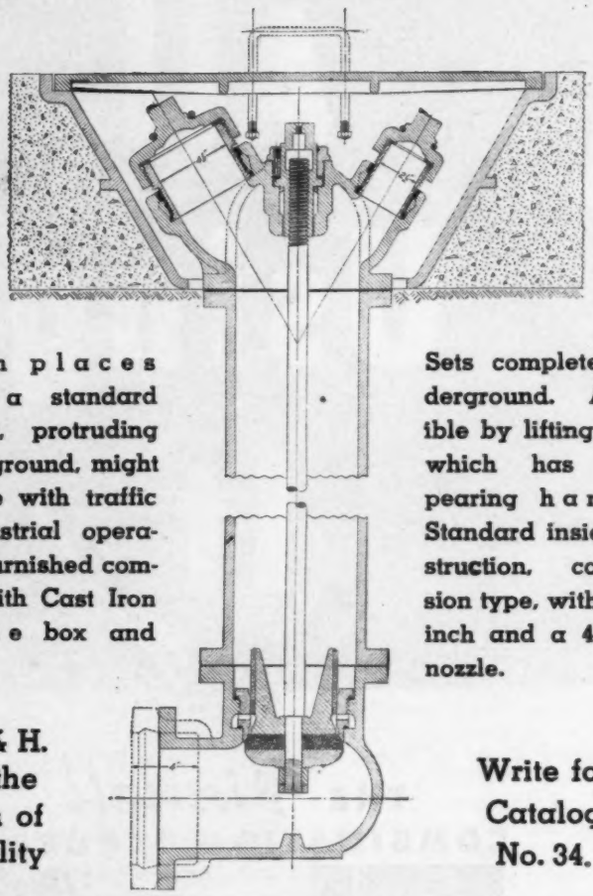
FINNELL SYSTEM, INC.

Pioneers and Specialists in

FLOOR-MAINTENANCE EQUIPMENT AND SUPPLIES

BRANCHES IN ALL PRINCIPAL CITIES

FLUSH TYPE Fire Hydrant



Used in places where a standard hydrant, protruding above ground, might interfere with traffic or industrial operations. Furnished complete with Cast Iron nozzle box and cover.

Sets completely underground. Accessible by lifting cover, which has disappearing handle. Standard inside construction, compression type, with a 2½-inch and a 4½-inch nozzle.

M. & H. is the sign of quality

Write for Catalog No. 34.

M. & H. STANDARD FIRE HYDRANTS are revolving head, dry top, bronze mounted. They are approved by "UA&FM". Entire main valve assembly is removable through barrel without digging. Special Traffic Model is fitted with breakable bolts and stem coupling, designed to break at ground line under impact. Repairs are made simply by renewing bolts and coupling, without shutting off the water.

M & H PRODUCTS INCLUDE

FIRE HYDRANTS
GATE VALVES
TAPPING VALVES
WALL CASTINGS
SPECIAL CASTINGS
TAPPING SLEEVES
CHECK VALVES
FLOOR STANDS
EXTENSION STEMS
SHEAR GATES
MUD VALVES
VALVE BOXES
FLAP VALVES
SLUDGE SHOES
FLANGE AND FLARE FITTINGS
FLANGED FITTINGS
B & S FITTINGS
CUTTING-IN TEES

WRITE FOR PRICES

M & H VALVE AND FITTINGS COMPANY
ANNISTON, ALABAMA

pay an employee a minimum wage of 37½ cents per hour if he did not earn that much by piecework, and that this arrangement was to cover any overtime, did not comply with provisions for overtime compensation under the Wage-Hour law. The contract contains no guarantee of a weekly amount to be received by the employee as required in the Belo case.

Under the doctrine of the Belo case the court will uphold such a contract between employer and employee, since many workers prefer an assured weekly income, if possible, as long as that income is above the minimum and complies with the hours provision of the Wage-Hour Act. (Walling vs. Livernois)

WAR LABOR BOARD

*Contract Suspended

A regional War Labor Board ruled that it had the right to suspend a contract and to order that the status quo be kept until the Labor Relations Board should decide which union represents the majority of employees. (United Automobile Workers.)

*Treasury Stabilization Ruling

The Treasury has ruled that periodic increases in salaries made in accordance with individual employment contracts in effect on October 3, 1942, with respect to rates above $5000 a year and October 27, 1942, with respect to rates below that figure, may be made without approval, provided they are reasonable in amount. Increases made under salary rate schedules may likewise be made without approval, provided they are both reasonable in amount and are within the limits of rate ranges in existence on October 3, 1942.

*Increases Without Board Approval

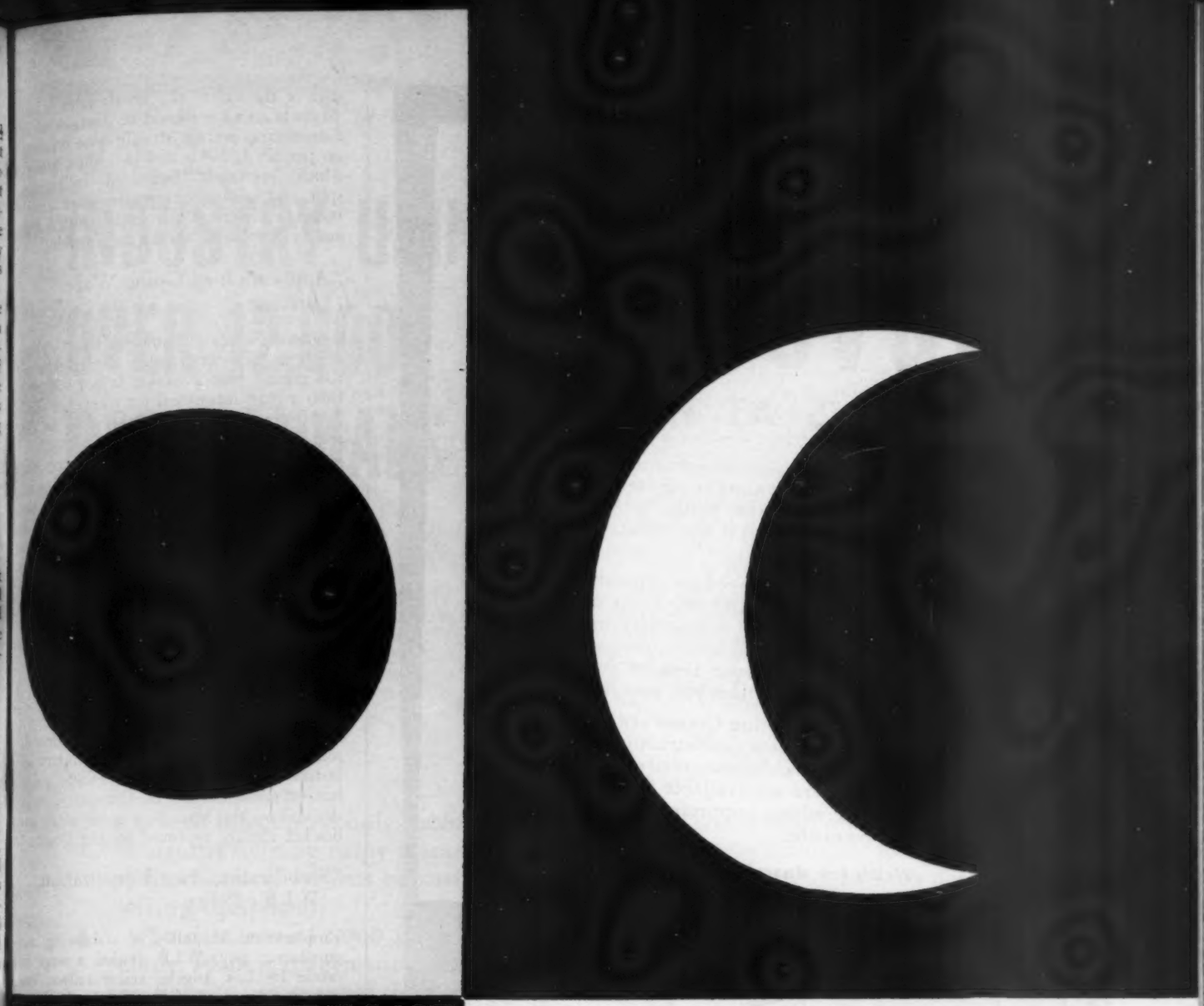
Adjustments in wages or salaries of employees of non-profit hospitals may be granted without Board approval where they do not raise wages or salaries "beyond the minimum non-inflationary going rates for similar occupational groups in the labor market area." (Amendment to General Order 26)

*Test of General Increase

The NWLB ruled that for a general increase to be considered a raise it must apply to at least 10 percent of the employees in the unit. The increase so granted must be separate and distinct from any increase granted for merit or through reclassification of jobs. In computing the amount of the general increase, the total sum given must be averaged over all the employees. (Federal Bearing Comany, Inc.; Schatz Manufacturing Company)

In amplification of these rules the regional Boards pointed out (1) raises granted to bring rates up to the minimum required by a wage order issued under the Fair Labor Standards Act should be disregarded under the 15 percent rule, even though made in advance of the effective

* In this and the following classification items marked with an asterisk also are considered to be trend indicators.



IT TURNS ON THE SUN WHEN THE MOON COMES OUT

INDUSTRIAL ELECTRONICS

THIS curious-looking device is an electronic light control, built for industry by General Electric.

When evening comes, or clouds gather, it automatically turns on the lights. When the sun comes up, or the clouds pass on, it automatically turns the lights off! Ideal for plant protective lighting, and office and schoolroom illumination.

Today there are literally thousands of electronic devices, developed by our engineers, at work in plants large and small. Electronics is not a promise for the future only; it is a reality today, as it has been for many years — a tool that speeds war output, cuts production costs, assures a more uniform product.

An electronic weft-straightener in textile mills detects skew in cloth and controls the operation which straightens it. An electronic pyrometer in steel and cement mills indicates and controls temperatures. An electronic rectifier converts a-c to d-c power. An electronic drive system, known as G-E Thy-mo-trol, controls the speed of d-c motors operating from a-c power lines.

Many G-E electronic devices are completely engineered and standardized—that is, they come ready for immediate installation — for positioning, resistance welding, measurement, timing, inspection, counting, etc. General Electric engineers also design electronic equipment to meet your special requirements. And they design *the complete electric equipment* into which the electronic circuit blends.

Back of every G-E recommendation for your plant is our intimate knowledge of your industry, and years of experience in the science of electronics. A call to the nearest G-E office will put you in touch with an industrial electronics specialist. *General Electric Company, Industrial Divisions, Schenectady, New York.*

Hear the General Electric radio programs: The "Hour of Charm" *Sunday 10 p.m. EWT, NBC—*"The World Today" *news, weekdays, 6:45 p.m. EWT, CBS.*

GENERAL ELECTRIC

670-123-9330

The best investment in the world is in this country's future — BUY WAR BONDS

A WAR OF

Movement

BEGINS AT HOME

The job of seeing to it that materials and supplies are at the right place at the right time is no less important on the home front than on the battle fronts. Industrial schedules *must* be maintained if war objectives are to be gained.

Shepard Niles has long enjoyed the reputation of manufacturing the most complete line of cranes and hoists in America. Because of this and because they are specialists, manufacturing *only* cranes and hoists, they are in a position to recommend the proper type of equipment for any materials-handling problem you may have.

Overhead Electric Traveling Cranes are made in either welded or riveted box girder construction, in capacities from 1 ton to 450 tons. Representatives in or near all war production centers are available for consultation to help you determine where important materials-handling economies can be made.

Write for descriptive literature.

Typical 4-Motor, Cab-Operated, Over-running Electric Traveling Crane in yard service. Because all operating parts are completely sealed against dust, dirt and moisture, Shepard Niles Cranes and Hoists are equally serviceable indoors or out.

Shepard Niles

CRANE & HOIST CORPORATION

364 SCHUYLER AVE. • MONTOUR FALLS, N. Y.

date of the order; (2) hourly rates below 40 cents an hour should be disregarded in determining average straight-time earnings on January 1, 1941; and (3) where groups which previously bargained collectively split and negotiate separate wage agreements, each group should be treated separately in applying the 15 percent rule.

*Application of Going Wage Bracket

Regional Boards are now holding the line at about 10 percent below the average on the ground that a worker is not suffering from a gross inequity if his wages are within 10 percent of the average paid in the area for the particular job.

In applying the going wage brackets, the Regional Boards consider the following factors: (1) The rates apply only to the occupations in the industries specified in the order establishing them; (2) increases up to the sound and tested rates set by the board may not be made without the board's approval; and (3) employees who are now getting more than the rate established by the board may continue to receive their present rates of pay.

*Speeding Adjustment Procedure

WLB authorized its wage stabilization directors to make decisions in voluntary adjustment cases in which a definite policy has been established or the case can be decided on the basis of a going wage rate bracket already approved by the Board.

*Stabilization, Not Equalization, WLB's Policy

Emphasizing its policy of stabilizing, not equalizing, pay, WLB denied a wage increase for Los Angeles street railway employees in excess of the Little Steel formula in order to hold the "battle line against inflation." Only in rare and unusual cases will the Board go beyond regional boundaries to ascertain proper wage rates. (Los Angeles Railway Company)

*Wage Negotiations Despite Escalator Clause

WLB ruled that a permissive cost-of-living escalator clause does not bar negotiation for wage changes on grounds other than cost of living. The Board ordered an increase to bring wages to the minimum of the bracket of going rates for similar work in the area. (U. S. Rubber Reclaiming Company, WLB)

Computing 15 Percent

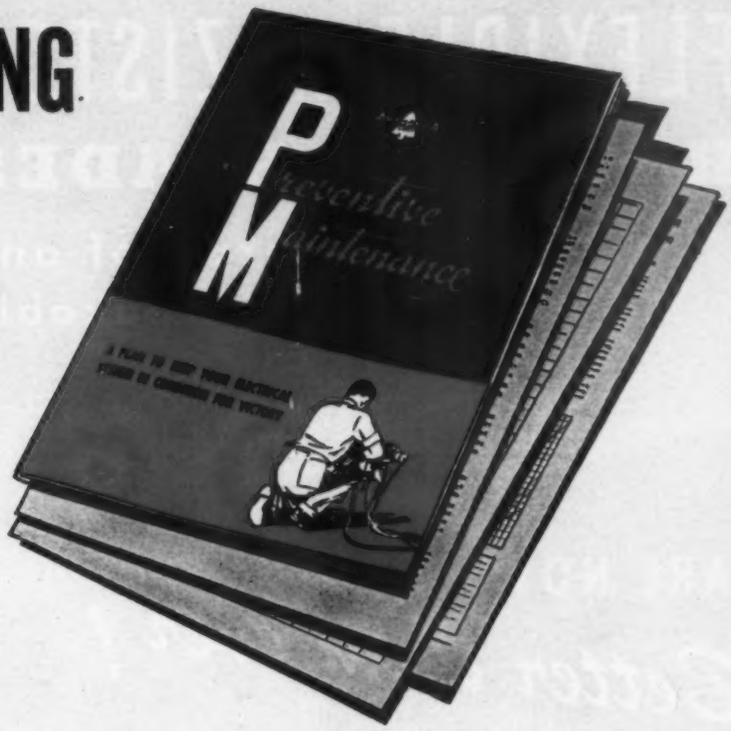
WLB, in granting an increase of $7.36 a month to five employees, ruled that increases since January 1, 1941, that had been granted for merit and promotion were not to be computed in estimating the 15 percent (Little Steel) formula.

*Raise Above 15 Percent

WLB granted an increase in excess of 15 percent where a critical shortage of workers was impairing mining of fluorspar, a vital war material, and the raise was neces-

INDUSTRY USING OVER 12,000 PM MANUALS

—because PM helps maintain continuous peak production



Though introduced only recently, Anaconda's Preventive Maintenance Plan is already helping many plants maintain continuous production by keeping their electrical systems operating *efficiently*—despite shortages in essential wiring equipment.

To date, over 12,000 Plan Manuals have been sent to industrial concerns alone. Plant management is using them to protect the electric wire and cable on hand . . . to see that these vital copper products are being properly used . . . to detect hidden electrical weaknesses that can be corrected.

WHAT THE PLAN IS

The PM plan is a simple but comprehensive way to safeguard war production by preventing electrical breakdowns *before they develop.*

HOW IT WORKS

The plan provides a practical means of making periodic, systematic analysis of circuits and equipment. Uncovers potential weaknesses . . . suggests ways to correct them . . . prevents overloading of lines.

Data thus gathered aids local W.P.B. Branches in reaching decisions on requests for materials to *prevent* breakdowns.

HOW UTILITIES BENEFIT

The PM plan helps utilities maintain close customer contact despite a lack of "something to sell." Offers basis for service campaign that definitely appeals to customers. Puts the utility in a leadership role for furthering war production throughout the area it serves.

If you aren't already utilizing the Anaconda Preventive Maintenance Plan, mail the coupon for full details.

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"Tomorrow may be too late . . . do it today!"

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Please send copy of the Anaconda Preventive Maintenance Plan for safeguarding wartime production.

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Company .....

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FLEXIBLE REZISTOR HACKSAW BLADES

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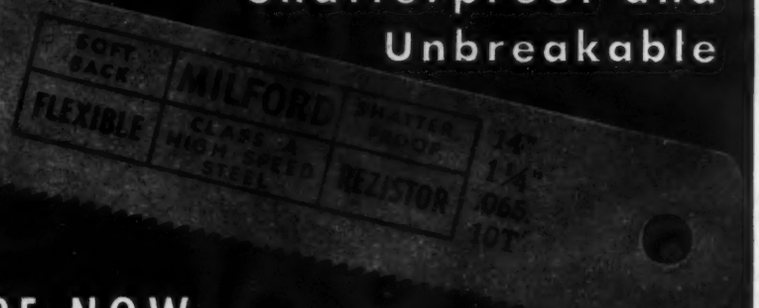

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Fast cutting, shatterproof, and unbreakable under excessive pressures and shocks, it is more than ever the blade for insuring trouble-free production on your automatically fed hacksawing machines. *It will pay you to specify* MILFORD FLEXIBLE REZISTOR *by name.*

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THE HENRY G. THOMPSON & SON COMPANY

NEW HAVEN, CONNECTICUT

also manufacturers of Milford Profile Saw . . . THE blade for all contour and profile band saw machines.

sary to assist the producers in obtaining and holding employees. (Fluorspar Mining Industry)

WLB Decision Reversed

Conceding its error, WLB reversed its original decision with respect to the retroactive date of a wage increase, and ordered the company to grant it as of 4½ months back. (Flannery Bolt Company; Oliver Iron & Steel Corporation)

**Increase Rescinded*

A Regional WLB (Dallas) rescinded a prior order authorizing an increase when it discovered that the data on which it had based its approval of the adjustment showed no differential during peacetime. The Board, however, ruled that the rescission was not to affect wages already paid. (Loffland Bros. Company)

Regional WLB Ruling Reversed

WLB reversed a Regional Board in ordering an increase where the increase had been agreed to prior to October 3, 1942, and was not in violation of the policy of stabilization. (American Brake & Shoe Foundry)

**Compulsory Bonus*

Regional Board ruled that a voluntary Christmas bonus becomes a part of a company's wage schedule if paid for a period of several years, even though the company's profits for that year were considerably lower and its prospects for the current year were uncertain. (Nineteen Hundred Corporation)

Union Security

For the maintenance-of-membership clause to be equally binding with the standard clause, which specifically makes continuation of jobs depend on continuation of membership, it need not be written in the contract. (Kennecott Copper Corporation)

Union Security Denied

A regional WLB denied a union security clause to a union on the ground that the union would be granted too much power over its members. If the union could expel a member, it could expel him from employment. (Sargent & Company)

WLB denied a membership-maintenance clause to a union on the employer's plea that relations with the union have always been friendly and imposing of the requirement would bring enmity. (H. D. Hudson Manufacturing Company)

**Union Shop Clause Ordered*

The War Labor Board ordered the continuation of the union shop clause on condition that the president of the international union make a report to the Board regarding steps taken to fix responsibility for the strike (which it claimed was provoked by the company) and prevent any recurrence. (Brew Schneider Company, Inc.)

In another case the Board ordered that a union shop clause be continued despite an employer's claim that the union secu

No other war had landing barges like these

nor the modern *Preformed wire rope* to handle them

To swing a landing barge over the side and set it safely down on the water—that's another new problem of this new, hard, global war. Again Preformed Wire Rope has been selected, this time for the rope and slings that handle the barges. There seems no end to the war uses of Preformed.

In peace, men learned that Preformed Wire Rope could be depended on for greater stamina, longer life, protection of men and equipment, and lower cost. In war, such qualities are indispensable. So at *all* times Preformed is given the hard jobs. For detailed reasons—

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MOTORS AND CONTROL

ity provision should be reduced to maintenance of membership because most of the craftsmen in the company's labor market area belong to a rival union. (Safeway Trails, Inc.)

Discharge Ordered

Regional WLB decreed that an employer must discharge employees who failed to retain their membership in the union, despite the fact that the contract violated the National Labor Relations Act. (Pearson Candy Company & Candy Makers Union)

**Leave of Absence for Union Officers*

WLB ordered a company to grant leaves of absence to employees who were elected to union offices, providing for reinstatement without loss of seniority already accumulated. The order was based on the fact that this procedure would insure more responsible union leaders and would improve relations between the company and the union. (American Cyanamid Chemical Co., WLB)

**Compensation for Grievance Procedure*

WLB announced that unions should pay their own grievance representatives so that their work may be carried out on a basis independent of the employer, and that settlement of grievances is part of management's personnel responsibilities for which it should expect to pay.

If the union wishes the board to require the company to pay for time spent by union representatives in handling grievances, it must be shown that payment by the company is essential for the proper functioning of the grievance procedure, and the union must make positive suggestions to prevent abuse of the system by union representatives. (McQuay-Norris Manufacturing Company)

Two Shifts Within 24 Hours Constitute One Work Day

In interpreting the term "work day" as used in the Presidential Premium Pay Order, the Department of Labor ruled that two shifts within the 24-hour period designated as the work day may be considered as only one day of work for the purpose of the double time provision.

Employees may possibly be given extra compensation for the emergency work itself, if such a premium was provided for by a contract or practice existing at the time the Order became effective.

Part-Day Absences

The Department of Labor, further construing part-day absences as breaking the sequence of days for purposes of seventh day double time, ruled that whether absences for part of a work day should be considered justifiable will depend on the individual case.

**No Premium Pay for Sixth Day*

In another case the Board denied a union's request for the payment of time and one-half for work on a sixth day, even though such work is not after 40 hours per week. The Presidential Order providing for

Every day M-D sweeping tools are being adopted by scores of industrial firms. Since Pearl Harbor they have replaced ordinary brushes and push brooms in literally thousands upon thousands of busy factories.

Why this tremendous swing?

Because business men have been quick to recognize that M-D sweeping tools fit perfectly into accelerated production. They make for faster, cleaner, easier sweeping. They stand the gaff in constant and hard use.

There is a specially designed and constructed M-D sweeping tool for every purpose, from the most sanitary control of fine dust particles to the easiest handling of heaviest litter.

If you can supply a priority rating of AA-5 or higher, you can put M-D sweeping tools to work in your business at once.

"Blue Book of America's Finest Brushes" tells the whole story about M-D sweeping tools and helps you make the right selections. Ask for a copy today.

" ... how are we doing it, John?"

INTER-OFFICE MEMO

To: John McGuire Factory Supt. **Subject:** Miscellaneous New Ideas

Dear John:

I sat next to Tom Scanlon at Rotary this noon and got to asking him about his mill supply business. When I asked him what, if anything, his men could be talking about these days, he gave me a few examples from just one of his lines — the "Blackhawk" line, he called it.

It sounded good to me and I know you'll want to check into it. Seems that they have a special hydraulic jack called "Porto-Power." It works in all directions and hooks up with attachments to push, pull, clamp, bend, etc. It's used in pulling gears, bending pipe, lifting and moving machinery and doing a lot of other tough jobs that, Tom says, ordinarily take any plant twice the time and manpower with old methods.

And I always thought all wrenches were the same until Tom started describing Blackhawk wrenches and how some of their special features cut down assembly time.

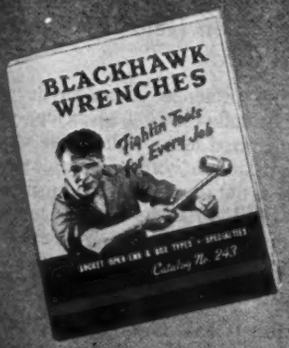
About this Porto-Power for lifting and moving machinery ... how are we doing it, John?

Bill

General Manager

Write for this BLACKHAWK *Literature on*

HYDRAULIC JACKS • PORTO-POWER • WRENCHES



WRENCH CATALOG—Features quick-detachable interchangeable socket wrenches that have the patented "Thumb Release Lock-On" feature. Also open-end and box-type wrenches and specialties.

HYDRAULIC EQUIPMENT CATALOG—Jacks, up to 50 tons capacity, all one-man operated. Porto-Power for maintenance and production work—pipe bending. Gauge equipment for measuring vast tonnages.

TORQUE INDICATOR BULLETIN—Torque Indicators assure uniform tension on nut and bolt assemblies—prevent bolt breakage, excessive wear, loss of compression and many other mechanical ills.

FREE BLUEPRINTS show how to build your own shop press for use with 20 and 50-ton Porto-Power Hydraulic Units.

"MEET THE MECHLINS" — a new booklet presenting valuable tips on speeding up production through more effective use of standard wrenches. Contains helpful hints on tool conservation.

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premium pay does not make mandatory the payment of time and one-half for work on a sixth day. Futhermore, such a provision might even cause absenteeism, the very evil the Order seeks to cure. (Agicide Laboratories, Inc.)

*Management's Right to Determine Rate of Pay

The War Labor Board denied a union's request for joint determination of piecework rates on the ground that such determination is normally the prerogative of management. The employees are amply protected, through their right to present allegedly improper rates as grievances under the grievance procedure. (Firestone Tire & Rubber Company)

NATIONAL LABOR RELATIONS BOARD

*Jurisdiction Refused

NLRB declined jurisdiction over a construction company building an air training center for the Navy, when it decided that the facts shown do not justify the Board's assuming jurisdiction; nor would the policies of the Wagner Act be effectuated. (Brown & Root, Inc.)

*Discharge Justified

NLRB approved discharge of employees who failed to remain union members under a maintenance-of-membership clause. (Utica & Mohawk Cotton Mills, Inc.)

*Test of Lawful Free Speech

In determining whether anti-union remarks are legitimate as a lawful exercise of free speech, the test is whether the employer used that freedom of speech threateningly or coercively. (Jacksonville Paper Company)

*Inside Union Held Not Company Dominated

While the presence of an inside union would normally arouse suspicion, where it was organized as a result of the employees' dissatisfaction with an outside union's agent it is not necessarily company-dominated. (Hill Independence Manufacturing Company)

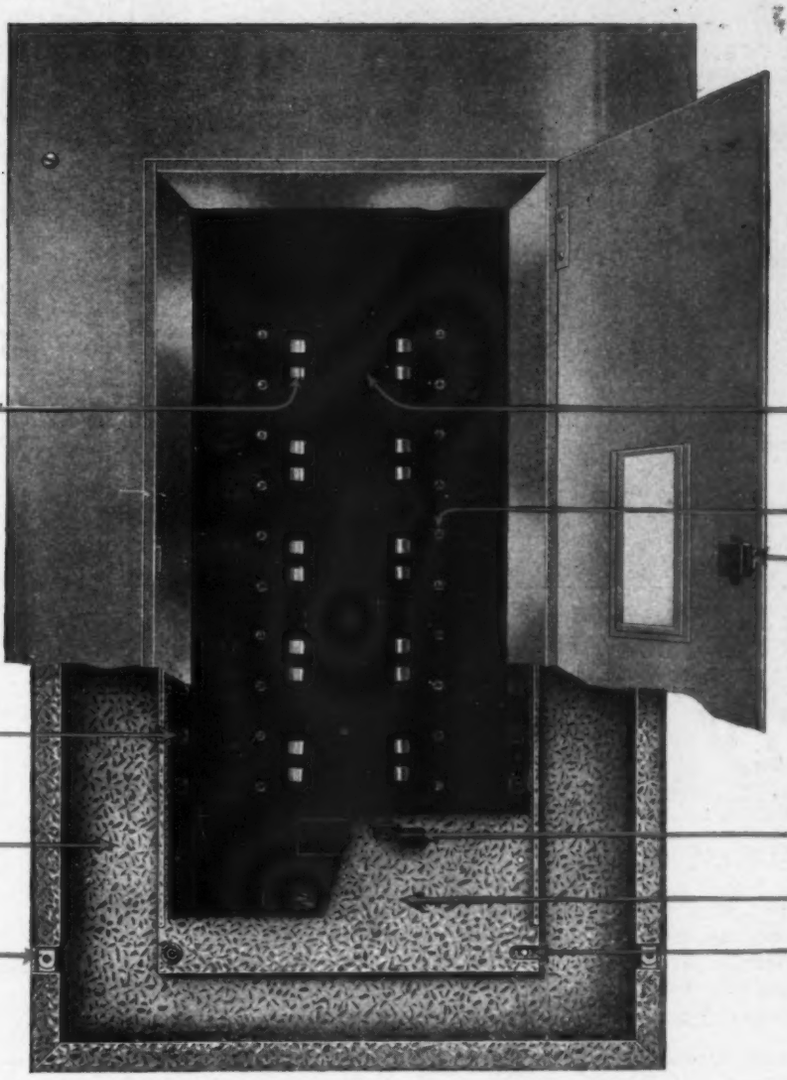
*Grievance Procedure

NLRB ruled that employers may operate their own grievance procedure parallel with any grievance procedure set up under a collective contract. The latter was not intended to impede the exclusive right of the majority union to bargain for all employees. (NLRB vs. North American Aviation, Incorporated)

Held Not Refusal to Bargain

Pennsylvania Supreme Court held that an employer did not commit an unfair labor practice (refusal to bargain) when he dealt individually and collectively with employees without communicating with a union to which the employees had ap-

This (FA) Lighting and Appliance Panelboard is *safety type* under all operating conditions


(FA) 30 Amp., S. P. Tumbler Switch with Bakelite Handle
(FA) Branch Circuit Wire Terminal Connector
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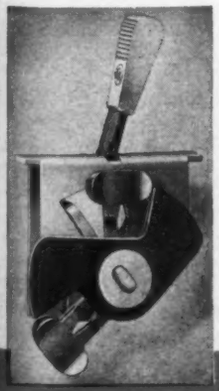
(FA) Adjustable Trim Fastening Device
One-piece Brown Bakelite Section
Circuit Numbering Tag
(FA) Catch Lock on doors 48 inches or less in heighth
Main Lugs under blank section
One-piece galvanized steel mounting back
Four Mounting Slots instead of holes

This shows the rugged yet simple design of the (FA) 30 ampere Tumbler Switch used in (FA) LNT1P Panelboards.



Each section is of Bakelite, *molded in one piece.* There are no removable covers to fall off or become loosened by tampering . . . All parts, including the switches, are applied from the rear . . . The switch frames, main contact members to bus, and the required rivets to secure other parts, *are molded into the section* . . . Screw connections have been reduced to the minimum to assure uninterrupted service. The connection between the main bus bar and the branch circuit switches is accomplished by means of a new design clamp contact, which also contains the branch circuit switch contacts as an integral part. Direct copper-to-copper contact is thus secured without the use of screws or other accessories.

Each section contains four (FA) 30 ampere, single pole, heavy duty tumbler switches, with plug fuse connections . . . Branch Circuit tumbler switches are rated 30 amperes, 250 volts DC, and are of the quick-make, quick-break type, with double-break contacts.

(FA) Panelboards, for surface or flush mounting, are available with from 4 to 42 branches; with main lugs only, or with safety type main fuse disconnect, or (FA) Shutlbrak safety type main switch. They are fully approved by Underwriters' Laboratories, Inc.

Write for Bulletin 67

It contains complete descriptions, specifications, sizes, wiring diagrams, and prices . . . Frank Adam Electric Company, St. Louis, Mo.

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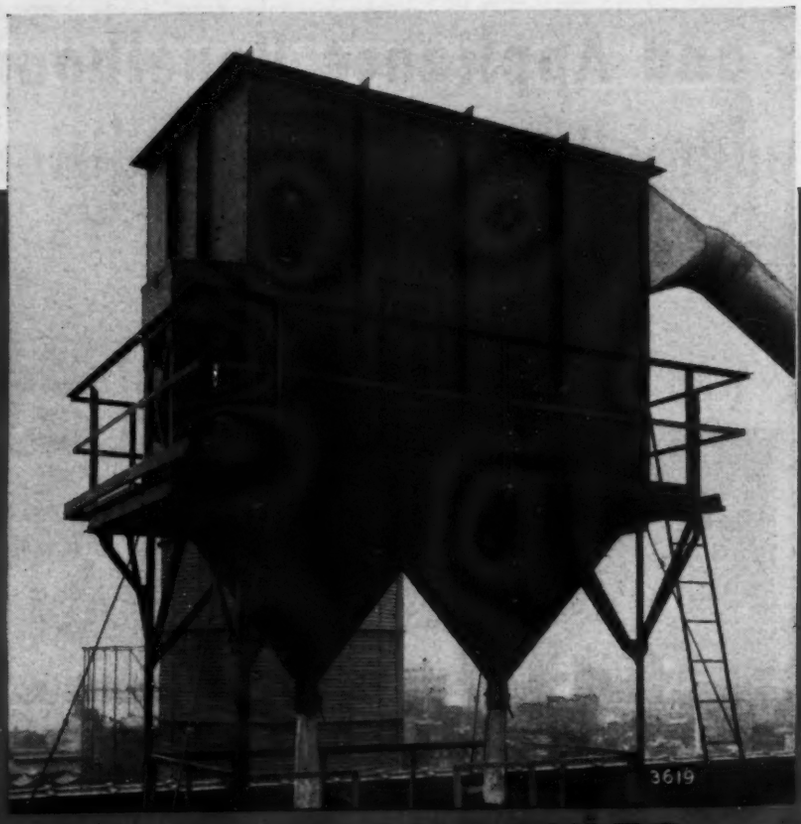

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WITH SLY DUST CONTROL

Sly Dust Filter in a factory operation exhausting 10,000 cu. ft. of air per minute.

Valuable man-hours are being saved, production increased, quality of products improved, machinery and equipment life lengthened through Sly Dust Control.
Sly Dust Filters (the heart of the system) embody these important and *exclusive* features:

1. Greater filtering capacity because of more filtering cloth
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plied for membership. (Penn LRB v. Schlossman)

*Picketing Enjoined; Upheld

The Michigan Supreme Court ruled that where the object of a strike and picketing was unlawful it could be enjoined. Interfering with a business right by interfering with its free flow of labor was held to constitute such an unlawful objective. Furthermore, no labor dispute was involved. (Lafayette Dramatic Productions Inc. vs. Feventz)

On the other hand the Minnesota Supreme Court upheld the right of unions to picket for the purpose of compelling an employer to hire out to contractors work which he has been doing himself. (Glover vs. Minneapolis Bldg. Trades Council)

*Discrimination

Management's penalty for disciplining workers may not be stricter in the case of union members than in the case of workers who are non-union members. (Ford Motor Company)

Penalty for Discrimination

For discriminatory discharge of employees who were also evicted from company owned houses, the Board ordered the employer to reimburse the expense of finding and moving into new quarters. (Industrial Cotton Mills Company)

*Reinstatement of Economic Strikers

NLRB ruled that if an employee refuses to take a job vacated by a striker growing out of an economic not a labor dispute he must be reinstated when the strike is over. If the employer fails to reinstate he may be liable for back pay even though the striker had not applied for the job. (Pinaud Inc.)

*Domination

Management's use of a union to disseminate information and secure acceptance of its plans and policies, and making the union the medium for expounding its views concerning such policies, constitutes company domination. The Board found further evidence of domination in the permission to hold elections on company time and property as well as the grant of facilities required for holding such elections. (Duncan Foundry & Machine Works, Inc.)

Interference

An employer's announcement that he will in no circumstances sign a closed shop contract with a union which has not yet asked for bargaining rights, was held interference. (Rodgers Hydraulic Inc.)

*Minority Entitled to Job Insurance Benefits

The Washington Supreme Court decided that members of a minority union which has lost an NLRB election are entitled to job insurance benefits in the event of a strike, since the minority group had no

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THE SAW IS MIGHTY FOR WAR SUPREMACY

● E. C. Atkins and Company has been entrusted with the responsibility of keeping saws cutting tirelessly in thousands of plants. For, in this war, the saw which cuts the numberless parts which go into mechanized armaments is a tool of paramount importance. Every weapon, machine or instrument of war begins with a cutting stroke.

We are proud to report the use of Atkins Saws in many new plants cutting new materials, with the success to be expected of 86 years of experience. Combined with experience are numerous practical demonstrations by Atkins engineers—all with a view to getting the right tool on every specific cutting job.

In the metal cutting field, saws of the "Curled-Chip" design have set new high standards of metal cutting saw performance. Atkins Engineering extends to other fields—to the timber industry with equipment like the new Electric Tree Faller—to supplying saws for technical units ashore, afloat and aloft.

Thus is Atkins' all-out production meeting the demands of all-out war.

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IN EVERY PHASE OF WAR PRODUCTION

MORE PRODUCTION
WITH PRESENT MACHINES!

● TANNATE Leather Belting maintains top machine speeds even at peak loads . . . Grips tightly, delivers more power and keeps machines running smoothly with fewer shutdowns for drive maintenance.

Moisture, machine oils and many chemicals have little effect on Tannate. It will keep its grip and great strength even under severe operating conditions.

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Give Tannate a trial in your plant—let it help you get peak efficiency from your machines.

WRITE for our new Belt Length Calculator. Accurate . . . easy to use . . . free on request.

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"direct interest" in the dispute which brought about the work stoppage caused by the majority union, even though such union was the officially designated bargaining agent. (Polson Logging Company; Oxette Railroad Company)

NLRB Must Prove Contempt

The Circuit Court of Appeals ruled that the burden of showing that an employer is guilty of contempt is on the NLRB. (Kansas City Power & Light Company)

Refusal to Bargain

Management's claim that the right to lay off is wholly discretionary with it was held to be a refusal to bargain collectively. (Montgomery Ward & Company, Inc.)

**State Commission Not Bound by NLRB Findings*

The Utah Supreme Court held that the State Industrial Commission is not bound by the findings of the NLRB as to the employer's responsibility for a strike, but is entitled to make its own independent investigation of the strike. (Utah vs. Industrial Commission)

**State Union Curbs*

In furtherance of its announced policy to regulate labor unions, Florida now requires that business agents of unions must have been citizens and residents of the United States for ten years in order to qualify to perform their duties.

**Union Liable for Unfair Labor Practice*

The Supreme Court of Wisconsin sustained a finding by the State's Labor Board which found that officers of a union were guilty of unfair labor practices in coercing employees to pay back dues. (Christoffel vs. Wisconsin Employment Relations Board)

**Supervisors Denied Protection of Wagner Act*

Supervisory employees are not entitled to exercise bargaining rights under the protection of the Wagner Act. This ruling is not limited to situations in which the same or an affiliated union seeks representation of supervisory as well as production employees. The fact that the union seeking to represent supervisory employees is independent and unaffiliated is immaterial. (General Motors Corporation)

Test of Supervisory Employment

The Labor Relations Board decided that boss machine tenders come under the definition of supervisors, since they are paid on a salary basis, have authority to lay off ordinary employees, and can recommend the hire of new employees. (Chesapeake Corporation of Virginia)

The Board also ruled that a union representing supervisors and having a contract with an employer may also be designated as bargaining agent by non-supervisory employees. (Revere Copper & Brass Company)

ARMY E NAVY

TOMORROW is cast in the furnace of today—and not all the wisdom of the sages can make a good product from a poor pattern, nor sound material from an unsound melt.

★ ★ ★

In all its years, Union has projected into its castings the soundness of its metallurgical knowledge, the "know-how" of its pattern-making, understanding of the stresses of use. Union's men of science have always had Tomorrow in mind.

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The men of Union had Tomorrow in mind when they pioneered that new, tough steel called "Univan" . . . the Web-Spoke driving wheel center for locomotives . . . the amazing new-day method of combining cast and fabricated parts known as "Fabricasting."

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Even today, all-out for Victory, these men have the pattern of Tomorrow very much in mind. Though they may not be able to supply you promptly with goods until "unconditional surrender," they can and will think and plan with you—for your *better* products and *greater* profits.

UNION STEEL CASTINGS DIVISION OF BLAW-KNOX COMPANY • PITTSBURGH, PENNSYLVANIA

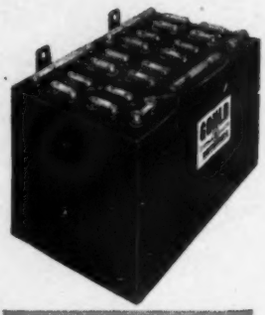
MAKERS OF:

Driving wheel centers, locomotive frames, pump casings, vault doors and frames, annealing boxes, spindles, coupling boxes, open hearth charging boxes, gear blanks—and other steel and alloy castings for steel mills and general industry.

GOULD FACTORY-BACKED SERVICE AT KEY POINTS AVOIDS COSTLY DELAYS, MAKES QUICK REPAIRS POSSIBLE

• Speed is the essence of today's production efforts. This has added new strains on men and equipment. In hurrying to make delivery dates machines are forced to new highs, with the result that breakdowns and accidents do occur. Storage batteries are no exception to this rule.

Realizing the need for quick repairs Gould has created a special factory-backed service at key points throughout the United States. Through the completeness of Gould equipment, and the know-how of the eight Gould factories, injured batteries will again be on the firing line as good as new, with a minimum of delay.



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The original spun glass battery tested by 20 years of actual service.

Rated Conservatively . . . *Goulds equal or exceed in capacity any battery of comparable size and cell structure.*

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FOR EXCELLENCE IN STORAGE BATTERY PRODUCTION AT DEPEW PLANT

GOULD

Since 1898 THE BATTERY PICKED BY ENGINEERS

THE SAGA OF A TRUCK

▶ It happened on the swing shift. Perhaps it was the poor light, or it may have been one man's endeavors to cut a corner, hoping to save a few second's time. In any event, there was a crash and the sound of cuss words out of the darkness. A platform truck has skidded, and gone over the edge.

By herculean efforts the crew managed to get the cases into the car and the order left as scheduled. The platform truck, however, was much the worse for wear. Repairs to the truck could be made in the factory shop, but the damaged battery was the bottleneck.

The superintendent decided to "*Call Gould*". A Gould service man was soon on the spot. All that could be salvaged of the wrecked battery was placed on a fast truck and rushed to the nearest Gould plant—one of the eight strategically located to serve American industry. There complete repairs were made, and less than 72 hours later the truck was again in operation.

Keep charged elements wet. When an element is exposed to the air for any length of time, you will notice a steaming action taking place. This is caused by the oxidation of the sponge lead in the negative plates. It is a quite rapid chemical reaction with the oxygen in the air and results in the generation of considerable heat, as well as the loss of charge in the negatives.

Whenever it is necessary to remove or otherwise expose an element of a battery, it is essential that it be promptly immersed in clean water or battery electrolyte. If the repairs involve prolonged exposure of the negative plates the separators should be taken out of the unit and kept saturated. Then allow the negative element to dry out in a free circulation of air. In this way, although the negative plates will discharge, they will not heat up enough to cause damage.

We would like you to know the Gould men who will take care of your industrial storage battery requirements.

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THE new General Electric line of ELECTRONIC MEASURING INSTRUMENTS is designed in the famous G-E Electronic Laboratory. It provides an extensive choice of compact apparatus for service, maintenance, or research.

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Please send, without obligation to me, the General Electric Measuring Instrument Catalog, F-1 (loose-leaf), for my information and files.

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GENERAL ELECTRIC

177-81

ELECTRONIC MEASURING INSTRUMENTS

THEY SAY AND DO

War Spending at Home and Abroad

The United States' biggest customer at the present is its own government. More than two-fifths of the goods and services produced in this country last year were absorbed by the government, or well over twice the percentage taken by government expenditures in 1938, according to a study made by the Division of Industrial Economics, National Industrial Conference Board. In actual figures the expenditure has been 42 percent of total output.

But at that, Great Britain has topped our figure by 12 percent, expenditures reaching 54 percent, or more than three times the share of national output absorbed by that government in 1938. In that year British government expenditures were 17 percent, while United States expenditures were 18 percent of national output. Private consumption expenditures have naturally declined in both countries since 1938.

Last year more than 9 percent of Britain's national product was contributed at the expense of private fixed capital, and there are indications that the United States has also begun to deplete its stock of privately owned capital goods.

From British experience and the similarity of the trends in both countries, further cuts in the share of goods and services going to the people can be expected as the war continues. Government expenditures should continue to increase but at a slower rate, while privately owned capital facilities can be expected to become more rapidly depleted.

•

Sanctions for Strikers Fixed by Executive Order

Texts of President Roosevelt's letter to William H. Davis, War Labor Board chairman, and of his Executive order on enforcement of directives of the WLB follow:

The Letter

Aug. 16, 1943.

Dear Mr. Davis:

I am writing you regarding the question of compliance with board orders under the War Labor Disputes Act which you and I have been considering. The act empowers the board to prescribe the "terms and conditions * * * governing the relations between the parties, which shall be in effect until further order of the board."

Congress intentionally left the enforcement of these orders to Executive action. I agree with you that it would be helpful, in the light of our combined experience in dealing with disputes under Executive Order 9017 and more recently under the act, to define a program for bringing about compliance in the relatively few cases in which Executive action may become necessary.

1. When an employer refuses to comply his plant may be seized and operated by the government in accordance with the terms and conditions of employment prescribed by the board. Less drastic sanctions, however, including control of war contracts, of essential materials, and of transportation and fuel, should be applied if this can be done without impeding the war effort. I am accordingly requesting the Director of Economic Stabilization to direct the application of any or all available sanctions of this sort by the appropriate agencies of government in cases of noncompliance reported to him by the board.

2. When a local union refuses to comply, by directing or advising workers not to work under the terms and conditions prescribed by the board, action by the responsible national or international officers has thus far, in all but one or two cases, sufficed to bring about compliance. If such action should prove ineffective, or if a national or international union should itself be the offender, the plant will be taken over under the War Labor Disputes Act and operated by the government, if this is necessary to prevent interference with production and to protect the workers who wish to work.

The act provides that in such cases the terms and conditions of employment effective at the time of taking over shall continue, unless the board modifies them upon request of either the union or the government agency operating the property. As a part of the compliance program the appropriate government agency at the time of taking over shall ask the board to modify its order so as to withhold from the union (by escrow in the case of checked-off funds) the benefits, privileges, or rights accruing to it as such under the agreement or proposed agreement with the employer, until the union demonstrates its willingness and capacity to abide by the obligations thereof.

All questions of fact in this connection, and the extent of any modification of the order, should be determined by the board. I am authorizing the Director of Economic Stabilization to issue any necessary instructions to government agencies in carrying out this policy.

Government operation in these cases will be conducted with the least possible interference with existing management. Plants will be returned to their owners as speedily as conditions permit, and in any event, as provided in the act, within 60 days after the restoration of productive efficiency. The board may, of course, on its own motion, except during government operation, modify its orders in any way it deems appropriate to insure compliance.

3. As to compliance by individuals, the act contains penalties for certain types of

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To carry today's loads at high speeds, the lubricant cannot be just "any old oil". It should be prescribed by a lubrication specialist, and made by a concern which knows the secrets of modern petroleum reinforcement.

Houghton qualifies both ways—in the oil itself and in the counsel given to help establish sound lubrication practice.

We start with the best selected stocks suited for the purpose, then treat those stocks to enable them to carry loads twice to four times as heavy as the same oils untreated. We treat them also to increase their resistance to leakage—better cohesion, and adhesion to metals. And there are other treatments to prevent sludging, to render them stable under severe conditions, without chemical change.

That's why we say that good oil plus skillful treatment means "oil with guts". Houghton's "fortified" oils are helping war production: may we demonstrate?

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interference with production, which it is the province of the Attorney General to enforce. In addition, sanctions can be applied by the Selective Service and the War Manpower Commission, and I am requesting the Director of Economic Stabilization to direct the application of any or all of such sanctions in necessary cases upon report by the Board of non-compliance.

I am informed that during the past 18 months the board disposed of over 20 thousand disputes. Only seven had to be referred to me because of persistent non-compliance.

This is a remarkable record, in the making of which the industry, labor, and public members of the board have each played an effective part. They could not have succeeded, however, without the patriotic support given to the national no-strike, no-lockout agreement by the great mass of American employers and workers and their leaders.

I am confident that that agreement which calls for final determination by the board of all disputes not settled by collective bargaining or conciliation, will continue to be supported; and it is my earnest wish that the sanctions described above, which exist only as a matter of wartime necessity, may not have to be invoked.

Sincerely yours,
FRANKLIN D. ROOSEVELT.

Executive Order

Authorizing the Economic Stabilization Director to take certain action in connection with the enforcement of directives of the National War Labor Board.

By virtue of the authority vested in me by the Constitution and the statutes of the United States, it is hereby ordered:

In order to effectuate compliance with directive orders of the National War Labor Board in cases in which the board reports to the Director of Economic Stabilization that its orders have not been complied with, the director is authorized and directed, in furtherance of the effective prosecution of the war, to issue such directives as he may deem necessary:

(a) To other departments or agencies of the government directing the taking of appropriate action relating to withholding or withdrawing from a noncomplying employer any priorities, benefits or privileges extended, or contracts entered into, by executive action of the government, until the National War Labor Board has reported that compliance has been effectuated;

(b) To any government agency operating a plant, mine or facility, possession of which has been taken by the President under Section 3 of the War Labor Disputes Act, directing such agency to apply to the National War Labor Board, under Section 5 of said act, for an order withholding or withdrawing from a noncomplying labor union any benefits, privileges, or rights accruing to it under the terms of conditions of employment in

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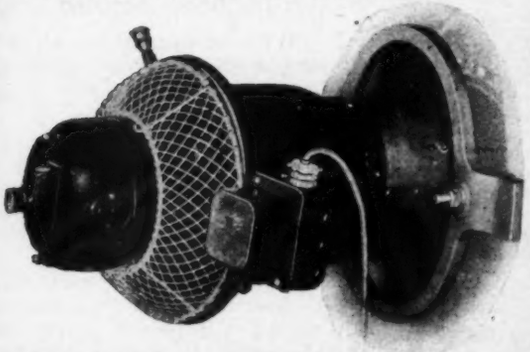
In tough, round-the-clock war production, cleaning furnaces, in tanks or underground manholes, around hot processes, don't let heat-fag or fume-fag sap your workers' strength.

Like so many others, you can get more productive minutes out of every man-hour by putting a Coppus "Blue Ribbon" Blower or Exhauster where it's needed.

Easily carried from place to place, adaptable to many special purposes, each one carries the "Blue Ribbon", mark of Coppus precision workmanship and rugged, year-round durability.



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THE BLOWERS THAT PUT MORE MINUTES IN EVERY MAN-HOUR

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MAIL THIS COUPON to Coppus Engineering Corp., 209 Park Avenue, Worcester, Mass. Sales offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in SWEET'S and THOMAS' REGISTER.

PLEASE SEND ME INFORMATION ON SUPPLYING FRESH AIR TO MEN WORKING:

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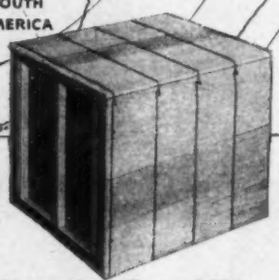
...solves EXPORT shipping problems

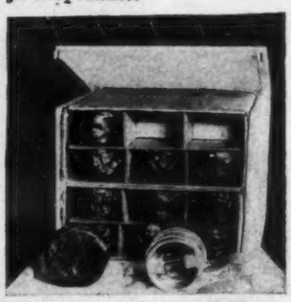
ROUGH sea voyages, rapid loading and unloading of merchant ships, frequent handling by careless native labor, journeys in rough riding trucks—these are but a few of the conditions that require *different* containers for export shipments. These are the conditions that the HEAVY-DUTY GENERAL WIREBOUND is meeting so successfully.

The Heavy-Duty General Wirebound box is made of ⅜" resawn hardwood lumber and is reinforced with binding wires stapled to four faces. Like the lighter domestic box, this export container provides maximum protection—minimum weight and size advantages. It is easy to pack and unpack, and has exceptionally high re-use value.

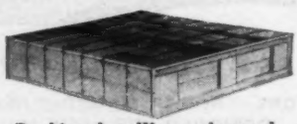
Available now only for the protection and safe delivery of war materials, the Heavy-Duty General Wirebound will, "tomorrow," solve many a peacetime export shipping problem.



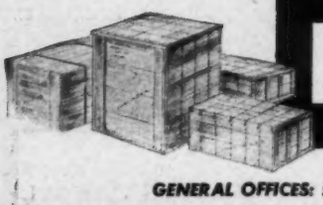
Heavy-Duty General Wirebounds are made in a wide variety of sizes and shapes—to fit the product.



Combined with new packing methods the Heavy-Duty provides protection against the elements, rust and corrosion.



Packing, handling and unpacking of shipments up to 1,000 pounds can be made faster, easier with the Heavy-Duty General Wirebound.



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effect (whether by agreement between the parties or by order of the National War Labor Board, or both) when possession was taken, until such time as the non-complying labor union has demonstrated to the satisfaction of the National War Labor Board its willingness and capacity to comply; but, when the check-off is denied, dues received from the check-off shall be held in escrow for the benefit of the union, to be delivered to it upon compliance by it.

(c) To the War Manpower Commission, in the case of non-complying individuals, directing the entry of appropriate orders relating to the modification or cancellation of draft deferments or employment privileges, or both.

FRANKLIN D. ROOSEVELT.

The White House,
Aug. 16, 1943.

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Manpower Commission Launches 3-Point Program

With the issuance of a list of "critical" occupations, the War Manpower Commission has set in motion a new, three-point program designed: (a) To hold essential workers on war-useful jobs if they are so employed now, (b) to assure transfer of workers to jobs aiding in the war effort, and (c) to supply men needed for the armed services without cutting war production.

As part of the program WMC also expanded the list of "non-deferable" occupations and revised slightly the list of "essential" occupations and industries.

Two major factors affected WMC's policy in announcing the program. First was its desire to find a means of making "voluntary" methods work, thus obviating a compulsory National Service Act of the type which Congress was preparing to debate. Second was the imminent induction of fathers, another Congressional issue of importance. Aim of the program was to make occupation the first consideration in all questions of Selective Service deferment, so that fathers engaged in non-deferable occupations might transfer to war jobs or prepare for induction.

It was emphasized that the new list of critical occupations did not render obsolete the older list of essential activities and skills. But those in critical occupations will, of course, receive primary consideration for deferment.

The critical occupations follow:

Part 1—Production and Services Occupations: Aircraft-engine mechanic, all-around; aircraft engine tester, all-around; aircraft instrument mechanic; aircraft mechanic, all-around; airplane navigator; airplane pilot, commercial; airplane mechanic, all-around; ballistician; Bessemer converter blower; blacksmith, all-around; blast furnace blower; blaster, mining; boat-builder, steel or wood, all-around; boilermaker, all-around; boring mill operator, all-around; bricklayer, refractory brick; cabinet-maker, all-around; cable splicer, telephone, telegraph, or submarine; cable transmitter and

Another Battle Flag Goes Up the Mast at UNION METAL

The United States Maritime Commission has honored Union Metal men and women with its highest award, the Maritime "M" Pennant, for outstanding achievement in the production of tapered tubular steel booms for America's Liberty Ships.

Now that proud pennant, and the Flag of the Victory Fleet, fly over our war-busy plant—together with "Old Glory", the Army and Navy "E", and the Treasury Flag.

Ever since the war began, Union Metal's diligent and patriotic workers have given, and pledge themselves to continue to give, the best that's in them to help speed victory.

Their acceptance of these several honors has been in a spirit of the deepest responsibility toward our Merchant Marine, our armed forces, and our country. It is their will to produce the most possible of the best materials of war in the shortest time.

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Cargo Booms — Top Masts — Practice Bombs — Recoil Mechanisms — Gun Mounts — and, in peacetime, Steel Street Lighting Standards — Monotube Steel Pile Casings — Steel Skids and Boxes — Monotube Steel Poles for Distribution and Transmission Lines

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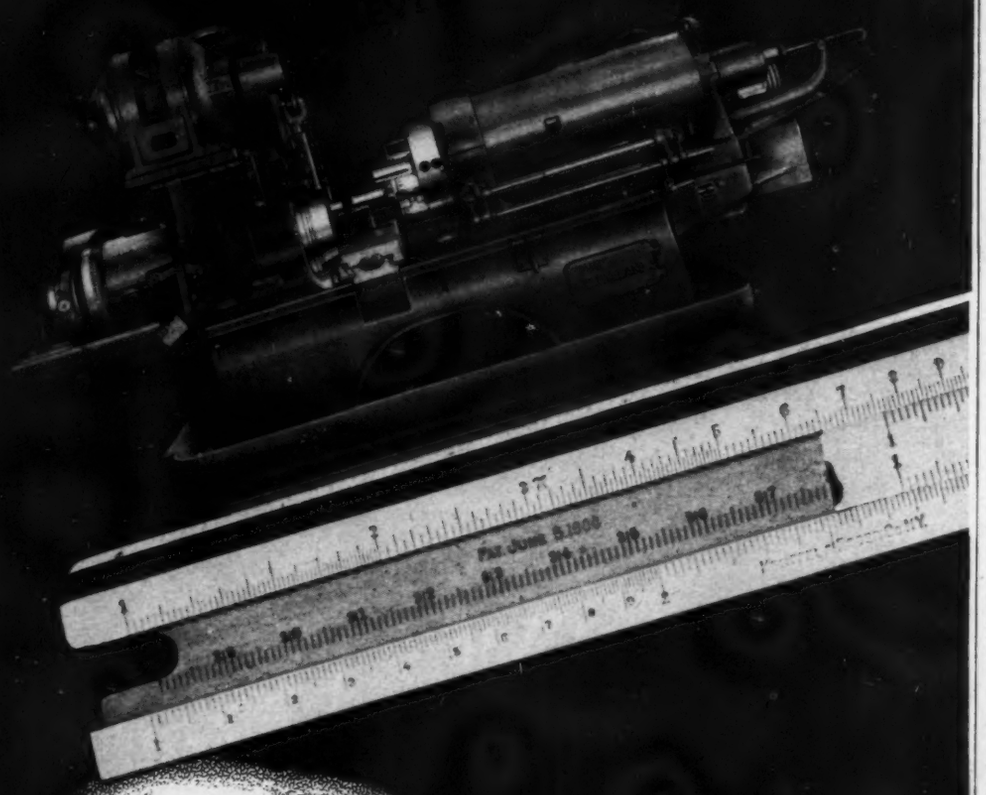

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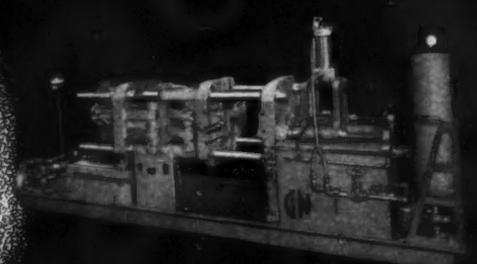

CLEVELAND *Single Spindle* **AUTOMATICS**

AND G&N DIECASTING MACHINES

receiver; cam-layout man; car inspector, railroad transportation; catalytic converter engineer, synthetic rubber; cementer, oil well; chainmaker, all-around; chamberman, acid; coke burner; computer, electric, seismic, or gravity; conductor, railroad transportation; converter operator, non-ferrous metal, smelting and refining; continuous still engineer, synthetic rubber; coppersmith, marine, all-around; coremaker, all-around; cutting machine runner, mining; diamond driller, mining; diemaker, all-around; diesinker; diesetter; diesel mechanic, all-around; dispatcher, radio communications, telegraph, or submarine cable; diver; driller, fine diamond dies; electrical tester, power equipment; electrician, installation and maintenance, all-around; electrician, aircraft, marine, power house, or submarine cable, all-around; engineer, chief, first, second, or third assistant, ship; engineer, locomotive, railroad transportation; engineer, turbine or diesel; engineering draftsman, design; finisher, fine diamond dies; first helper, open hearth or electric furnace; flight dispatcher.

Supervisory Jobs

Foremen—including only those who are (1) utilizing in their supervisory jobs the knowledge or skills of one or more of the occupations included in the list of critical occupations, and (2) those who supervise directly or through subordinate foremen and supervisors, production, technical, or scientific in essential activities, although the occupations of the workers supervised may not be listed.

Form blower, aircraft; glass blower, scientific laboratory apparatus; heat-treater, all-around; heater, steel mill, all-around; hoisting engineer, mining; inspector (included in this designation are only those workers who are qualified to perform in one or more of the critical occupations appearing in this list, and who utilize the knowledge and skill of such occupations in inspecting work in order to insure uniformity and accuracy of products or services); installer, telephone or telegraph equipment; instructor (included in this designation are only those workers who are qualified to perform in one or more of the critical occupations listed and because of their aptitude and experience have been assigned as instructors in training programs either in plant or vocational); instrument maker and repairer, electrical, mechanical, or scientific; jewel bearing maker, all-around; jointer, submarine cable; layout man, boilermaking, foundry, machinery, or shipbuilding; lead burner, all-around; lineman, telephone, telegraph, or power, all-around; load dispatcher, power or gas; locomotive engine repairman; loftsman, aircraft or shipbuilding; loom fixer; machinery, driller, mining; machine tool set-up man; machinist, all-around; machinists, marine, all-around; mate, first, second, or third; mechanician, communications equipment (this classification includes individuals who maintain and repair telephone and telegraph equipment and circuits, technical broadcast equipment, radio-telephone and radiotelegraph equipment, or submarine cable apparatus).

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No Slide Rule Formula

The Cleveland Automatic Machine Company's "Production Cost Patrol" is an engineering service. Its purpose is to provide a competent "outside approach" to your turning and forming problems, and, working in co-operation with your production experts, to seek out hitherto undiscovered waste in production methods.

Engineers who would come to your plant to perform this service do not merely ask a few questions, whip out a slide rule and a convenient formula for making changes. Instead, a thorough study of methods is made. Wherever possible, specifications of pieces in production are taken and samples produced by methods our engineer works out. If the new method affords improvements in cost and production, you are given a full report on the comparison between present and proposed methods, detailing every unit of time, manpower and equipment involved . . . showing not only HOW but WHY.

The steps to bring about such a study in your plant are simple . . . (1) Upon request you will be given a statement of our engineer's method of surveying your plant, and his credentials will be submitted. (2) The engineer will spend as much time as necessary in your plant, making detailed studies, without interrupting production. (3) A detailed written report will be made for you, with proposals for changes in method wherever opportunities for savings are found.

Write or wire for further information

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Thrilling *is* the word for Devopake's *one-coat* hiding quality. There are thousands of maintenance men who have been thrilled . . . and pleased when they found they saved time and money by using Devopake. Here's a paint that's a *primer and finish-coat in one* . . . no need for the usual time-consuming under-coat. And Devopake's *big-brush workability* quickens application time . . . saves vital man hours.

Devopake can "take it." Its oil-base protects walls . . . enables them to stand up under repeated washings. What's more, *seeing* conditions are improved because Devopake provides maximum reflection and diffusion of all available light, speeding war-time production.

If your interior walls need painting, write for circular on Devopake . . . now, by popular demand, manufactured in 7 practical colors.

Specify Devopake on your next paint job and save time . . . save money . . . enjoy complete, guaranteed satisfaction.

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wright; miner, underground, all-around (included under this title are only those individuals whose job assignment requires them to perform the duties involved in driving underground openings including drilling, blasting, timbering. Due to standardization of mining methods, these functions may be performed by separate individuals whose occupational titles also appear in this list because the jobs meet the criterion of critical occupations. Since the term, "miner," is generally used in the industry to identify underground workers, it should be clearly understood that it does not cover such workers as muckers, trammers, and helpers).

Others on the List

Molder, bench, floor, or all-around; model maker, all-around; observer, seismic; oil well gun perforator; oil well treater, acidising; optical mechanic, all-around; paper making machine engineer; patternmaker, metal or wood; pipefitter, marine; power shovel engineer, mining; precision lens grinder, all-around; pulpit operator, steel mill; pumper, refinery in charge; purification engineer, synthetic rubber; radio communications technician; radio telegrapher; radiophoto technician; reactor engineer, synthetic rubber; receiver tester, radio or radar; refrigeration equipment repairman, gas or electric, all-around; refrigerator engineer.

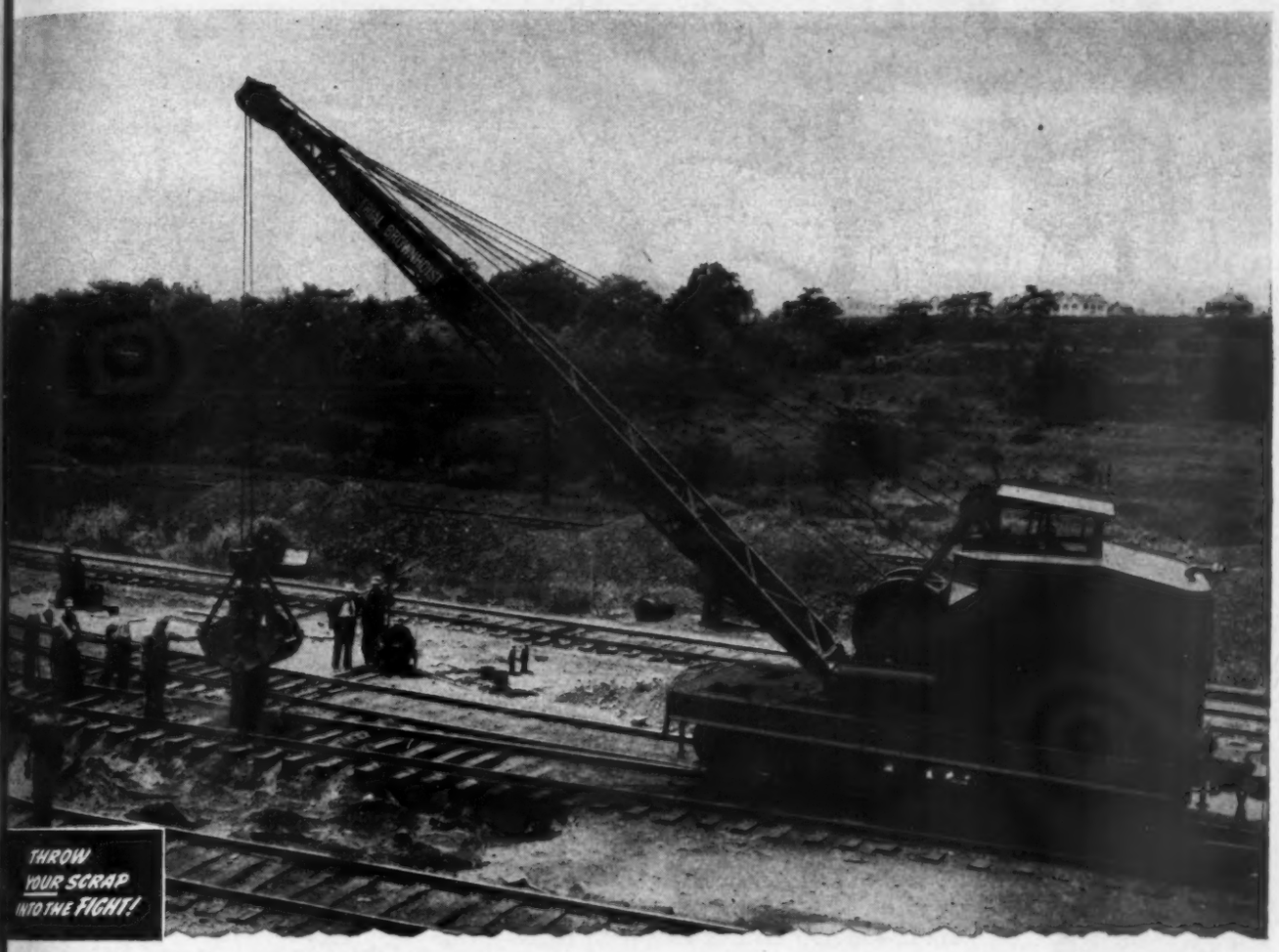
Sheetmetal worker, marine, all-around; shipfitter, all-around; shipwright, all-around; ship rigger, all-around; ship captain; ship pilot; signal maintainer; still operator, chemical, all-around; stillman, petroleum processing; supervisor (see foreman); switchboard operator, power; tanner, all-around; testing and regulating technician, telephone or telegraph; timberman, mining, all-around; tool designer, tool maker; train dispatcher; transmission engineer; tugboat captain; tugboat engineer; wood seasoner, kiln; X-ray equipment.

Part II—Professional and Scientific Occupations (including those engaged in the teaching of these professions and those engaged in full-time inspecting duties which require the utilization of the knowledge of the critical occupations): Accountant (included under this title are certified public accountants and those who have comparable training, experience, or responsibilities); agronomist; anatomist; architect, naval; astronomer; bacteriologist; chemist.

Engineer, professional or technical (this title covers persons who are actually engaged as engineers in the operating, research, or teaching phases of these professions, who are qualified either by having met the educational requirements or because of long experience. In addition this title is meant to include those individuals who may specialize in certain phases of the professions listed—such as mechanical engineers who specialize in the automotive, heating, or refrigerating engineering field, but whose special designations have not been mentioned: aeronautical, agricultural, ceramic, chemical, civil, communications, electrical, marine, mechanical, metallurgical, mining, petroleum, radio, safety).

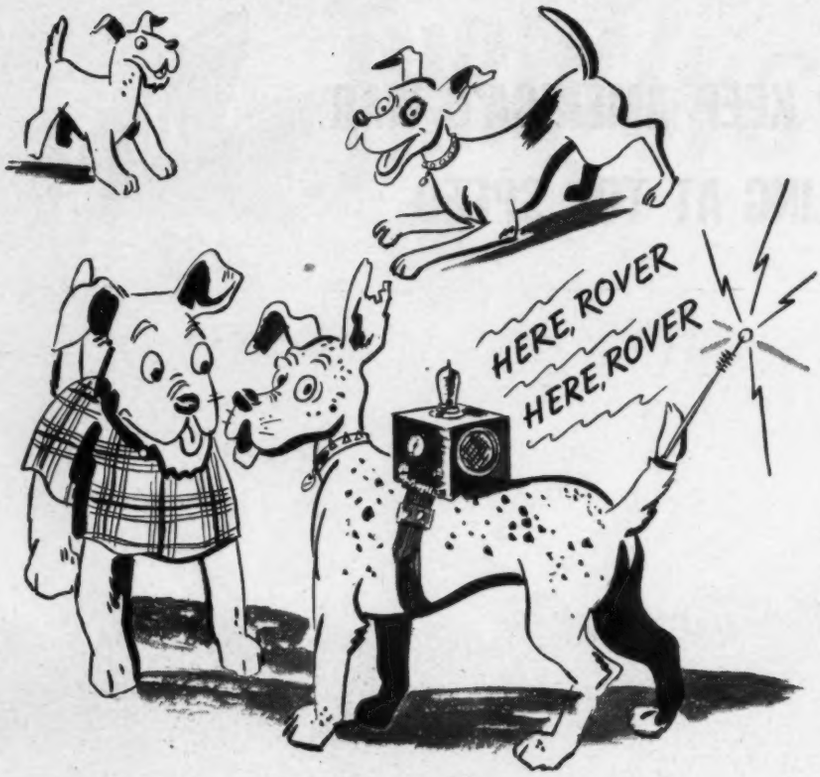
Entomologist; forester; geologist; geo-

I. B. CRANES HELP KEEP AMERICA'S WAR PRODUCTION ROLLING AT TOP SPEED



Here in America where thousands of tons of vital war materiel for the Allied Nations is being produced, Industrial Brownhoist Cranes are playing a vital role. On railroads, in chemical plants, in steel mills, in shipyards, on docks and in big industrial plants, I. B. Cranes are using magnet, hook and bucket to load, unload and move material at top speed up to twenty-four hours a day. I. B. Cranes are built to stand up—and they are standing up on their jobs—whenever and wherever they may be. Industrial Brownhoist Corporation, Bay City, Michigan. District offices: New York, Philadelphia, Pittsburgh, Cleveland and Chicago.

INDUSTRIAL BROWNHOIST BUILDS BETTER CRANES



When you gotta go... you gotta go!

CALLING Rover would be a cinch if you could equip him with a "walkie-talkie" set . . . and you might even teach him to reply, once he caught the spirit of the thing!

But, whatever its application after the war, the portable short-wave receiving-sending set will be electrically operated. And electrical circuits call for dependable connectors. Cannon Connectors will undoubtedly play an important role in all after-the war electrically operated communication equipment because they are proving their merit today wherever dependability is of paramount importance.

This Cannon Connector becomes an integral part of a carburetor primer cap for aircraft engines. Cannon Plugs are used in thousands of different places on all types of American aircraft as well as on ships, guns, tanks and radios wherever good electrical connections must be assured.

CANNON ELECTRIC

Cannon Electric Development Co., Los Angeles 31, Calif.

Canadian Factory and Engineering Office: Cannon Electric Co., Ltd., Toronto

REPRESENTATIVES IN PRINCIPAL CITIES—CONSULT YOUR LOCAL TELEPHONE BOOK

physicist; horticulturalist; mathematician (including cryptanalyst); metallurgist; meteorologist; neumatologist; oceanographer; parasitologist; pathologist, medical; pharmacologist; physicist; physiologist, medical; plant physiologist or pathologist; seismologist.

New Non-Deferable List

The new list of non-deferable occupations includes all those engaged in the manufacturing of the following products: alcoholic beverages; amusement machines and equipment, such as juke boxes, slot machines, games of chance, and pinball machines (does not include athletic and sport equipment); art goods, stamped and otherwise; artists' materials, decorative materials; book gilding, bronzing, and edging; costume jewelry; costumes, lodge, masquerade, theatrical, academic caps and gowns; curtains, draperies, and bed spreads; cut, beveled, and edged glass; cutware; decorative feathers, plumes, and artificial flowers; fancy fabrics, such as brocades, chiffons, damasks, laces, and lace goods, velvet, etc.; frames, mirror and picture; furniture, garden, beach, porch, toy; games and toys; greeting, souvenir, visiting, and picture postcards; jewelers' fixings and materials; jewelry; jewelry cases; lapidary work (non-industrial); merchandising display equipment such as cabinets and showcases (does not include refrigerated display equipment); mosaic glass; musical instruments, except for the armed forces; novelties, manufactured from materials of any kind, such as fancy boxes and containers, souvenirs, figures, models, carvings, ornamental shoe buckles, albums, costume novelties, etc.; ornamental gold and silver leaf and foil (non-industrial); pleating, stitching, tucking, and embroidery; signs and advertising displays; silverware and plated ware (non-industrial); smoking accessories; soft drinks; stained, leaded, ornamented, and decorative glass; trimming and art needlework.

Non-Deferable Services

Also non-deferable are those engaged in the following services: Amusement arcades; amusement ticket agencies; automobile-rental service; clubs—social, fraternal, business, and political; dance, music, theatrical, and art studios and schools; gambling; interior decorating; night clubs; parking lots; photographic studios; pool and billiard halls; race tracks and courses; travel agencies; turkish baths, massage parlors, clothing rental, porter service, and social-escort service.

Likewise non-deferable are those engaged in the following wholesale and retail trades: Antiques; artists' supplies; beer, wines, and liquors; candy and confectionery; custom furriers; florists; games and toys; jewelry; musical instruments; novelties; pet shops; soft drinks; and tobacco.

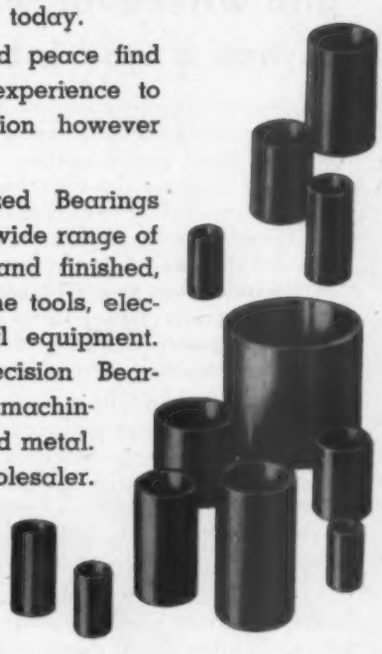
All the following occupations are non-deferable regardless of the activity in which they may be found: Advance-advertising agent; amusement-device operator; bar boy; bar cashier; bartender; bathhouse attendant; beauty operator; bellboy; billposter; book and periodical agent; booking agent; bootblack; busboy; butler; car

...Wherever Bearings Are Needed

● Bunting Bronze Bearing Service for both battle machines and factory machines is geared to the urgent needs of today.

Designers for both war and peace find here the facilities and the experience to meet any bearing specification however unusual.

Bunting Bronze Standardized Bearings are available from stock in a wide range of sizes, completely machined and finished, ready for assembly in machine tools, electric motors and all industrial equipment. Bunting Factory-Finished Precision Bearing Bronze Bars save 50% of machining time and 25% of purchased metal. Write for catalog. Ask your wholesaler. The Bunting Brass & Bronze Company, Toledo, Ohio. Warehouses in Principal Cities.



Bunting

BRONZE BUSHINGS • BEARINGS • PRECISION BRONZE BARS

and wherever wire screen has a war-job to do!

FAR-SIGHTED engineers who designed these maneuverable speed demons equipped their gas lines with filters to stand guard against *all* foreign matter. They had in mind the usual dirt, dust, and other particles which tend to clog many a gasoline line—to disrupt smooth, continuous motor operation. Little did they know that at Bataan, these tiny wire filters would even arm PTs against Jap treachery. For, when crafty Japs poured melted wax in our 100-octane gasoline, hoping to make our PT motors go dead permanently, these filters caught it all.

These are the kinds of war-jobs for Roebling Wire Screens woven from carefully manufactured wire and rod. Fine filters for all types of war equipment—tanks, jeeps, planes, trucks, and boats, keep fuel feeding evenly. Coarser screens, made from sturdier wire or rod, grade and sift crushed bauxite for aluminum production, crushed ore and coke and limestone for iron and steel.

Screens from 1″ rod stock to .001″ wire, with openings up to 6″, or down to 325 mesh—made of steel, brass, copper, phosphor bronze, stainless steel, aluminum or monel. Whatever your screen or filter problems, take them to Roebling for prompt help.

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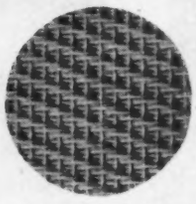
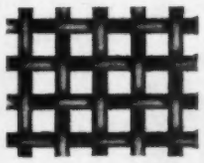
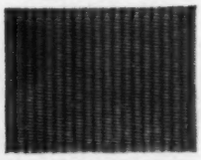
TRENTON 2, NEW JERSEY Branches and Warehouses in Principal Cities


DUTCH TWILLED WEAVE


OBLONG OR SQUARE MESH WIRE CLOTH


DUTCH PLAIN WEAVE FILTER CLOTH

JERSEY STRANDED FILTER CLOTH

ROEBLING
WOVEN WIRE SCREENS
JR ROEBLING

hop, curb services; car polisher; carwasher; caterer, social; charman and cleaner; cosmetician; custom furrier; dancing teacher; desk clerk, hotel, apartment, club, etc.; dishwasher; doorman and starter; elevator operator (passenger and freight, excluding industrial freight elevators used in connection with warehousing and production); elevator starter, passenger and freight; errand boy, including messenger and office boy; floorwalker; fortune-teller, including astrologer, clairvoyant, medium, mind reader, palmist, etc.; gardener; greenskeeper; groundkeeper; guide, sightseeing; guide, hunting and fishing; hairdresser; houseman; lavatory attendant; literary and actor agent; managing agent, theatrical and film; marker, in wholesale and retail trade; model; newsboy; night club manager and employees; porter (other than in railroad train service); private chauffeur; receptionist; sales clerk; sign painter and sign writer; soda dispenser; taxidermist; ticket taker; usher; valet; waiter (other than in railroad train service); window trimmer and display man.

Aimed at Strikers

In addition to the above, the status of "idleness" is to be treated as a non-deferable activity. WMC officials frankly conceded that this provision was aimed at strikers in war industries who could then be reclassified and their deferments cancelled.

Commenting on the new lists and their probable effect, Paul V. McNutt, chairman of WMC, said:

"The time has come when every worker must justify himself in terms of his contribution to the war effort. Under our Selective Service System, fathers were deferred so that single men would be taken first. Our instructions have always called and will still call for single men in essential jobs to be taken first. Fathers were not, however, given exemptions and there is nothing in the Selective Service Act which assumes that they should be passed by at the expense of the war effort itself.

"America is the only nation in the world which has recognized the fact of fatherhood, regardless of employment, as a clause for deferment at any stage of military mobilization. Fatherhood does not excuse any man from making his contribution to victory."

•

Peace-Planning a Part of War Planning

A gentle "unpiling" of the government's amassed critical materials may be the next job on the nation's list of "things to do." Seeing peace planning as an integral part of war planning, Washington's war agency leaders are looking toward a program for sound disposition of government-owned war plants, according to James H. McGraw, Jr., New York regional chairman of the Committee for Economic Development.

"The men who have been placing war contracts know that speedy and equitable termination of those contracts is essential to the successful resumption of a

Continuous PRODUCTION with VEELOS...the Link V-Belt

Veelos is the drive for the continuous grind of 'round-the-clock production ... for Veelos link construction permits quick adjustment and readjustment. Long shut-downs of machines ... upset production schedules ... are avoided. Where equipment must be kept moving, drive with Veelos!

VEELOS PROVIDES SIMPLEST ... SPEEDIEST READJUSTMENT OF ANY V-BELT!

When the belt of your trousers needs to be tightened or loosened, you simply take it in or let it out a notch. The readjustment of Veelos is as simple and practical as that! You lengthen or shorten Veelos simply by adding or removing links. Tension is easily maintained to end slippage without the need to move motors or install new belts.

The link's out! The belt's shorter! That's really all there is to Veelos readjustment.

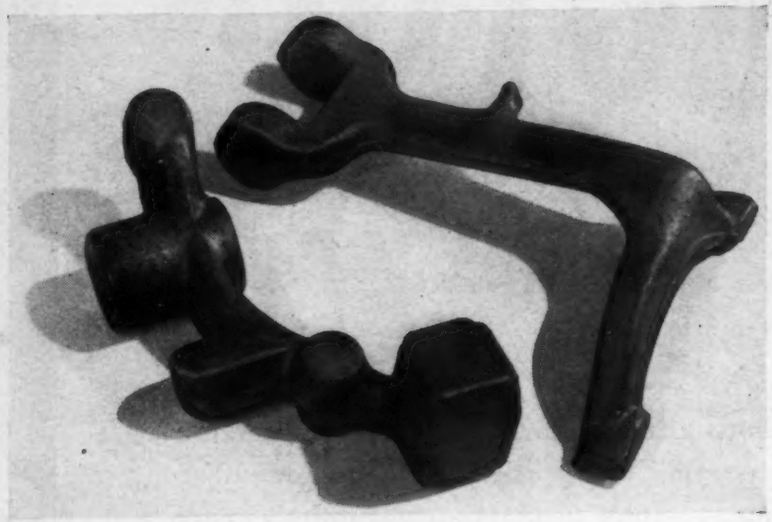
FREE! COMPLETE, NEW VEELOS PRODUCTION MANUAL

This free manual—"Drive Production Higher with Veelos V-Belt"—gives complete instructions on use, length table, engineering data, detailed description of Veelos link construction. Shows how to measure, couple, uncouple any size of Veelos. Write today for your copy of this valuable reference.

Veelos is made in all standard sizes (3/8", A, B, C, D, E) ... fits all standard V-belt grooves

VEELOS
THE LINK
V-BELT
ADJUSTABLE TO ANY LENGTH
ADAPTABLE TO ANY DRIVE

MANHEIM MANUFACTURING & BELTING CO.
MANHEIM, PENNSYLVANIA



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Serving American Industry Since 1834

RITCO

democratic free-enterprise economy that can handle its huge post-war responsibilities," he stated.

"There is a disposition among (them) to see the war picture as a whole and to think in terms of a carefully planned progress from current war production to still greater war production; then to an infiltration of essential civilian business; then eventually into peacetime capital and consumption-goods output. While these industrialists in government service still are chiefly concerned with combatting any letdown due to a public impression that the war is 'in the bag,' they know that they cannot neglect the kind of long-term thinking that recognizes preparation for peace as part of our preparation for war . . .

"According to one estimate, still to be checked, we have already made changes that have called for the cancellation of more contracts than were cancelled at the end of the last war. The shifts in the use of production and manpower as we have turned from old to new war requirements are giving us experience in handling the transition problems of exactly the same character that we shall encounter when such cancellations can be followed, not by different war orders, but by reconversion to peacetime order-filling."

•

Better Human Relations for Victory

(In a discussion of common problems and responsibilities of workers, management, and owners, viewpoints and experiences containing the following excerpts were exchanged under the above title at the recent Silver Bay Industrial Conference, Silver Bay on Lake George, N. Y., by Alvin E. Dodd, Lawrence A. Appley, Charles R. Hook, Jr., Robert J. Watt, and William L. Batt.)

Present-Day Industrial Relations

To bring into focus the chief industrial relations problems of America at war, Alvin E. Dodd, president, American Management Association, outlined the five main areas in which these problems lie.

1. *Manpower Supply.* The War Manpower Commission's estimate of 65.9 million as the nation's full manpower requirements by July 1, 1944, including 11.3 million in the armed forces, and British experience with labor stabilization both suggest that a National Service Act will ultimately be necessary. Meantime, it is estimated that 5,000,000 man-years could be added to the labor potential of the men and women already employed if we overcame excessive turnover, absenteeism, abnormal migration, such problems as transportation, housing, and training.

2. *Wages.* Employers are asking, "When will WLB set up adequate machinery to handle wage and salary increases with greater dispatch?" "In the face of rising living costs, how will future wage levels be controlled?" "Must we depend

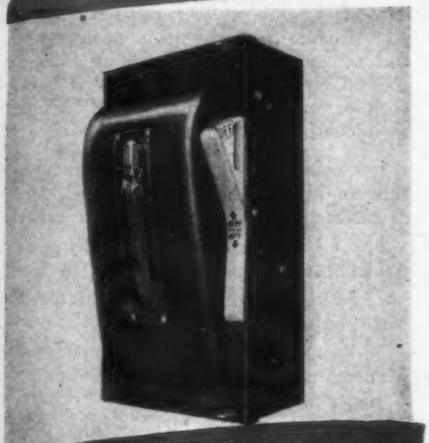
WHY Vacu-Break SAFETY SWITCHES?

Here's Why—

PARTIAL VACUUM quickly smothers arcs

CONTACTS (IN *ON* POSITION) tight as a bolted connection

CONTACTS MAKE AND BREAK with automatic ease



PUSH-TYPE, FRONT-OPERATED rocker handles enhance the fine effect of streamlined switch cabinets.

In the three illustrations above, a switch head has been cut away or removed to show the design and action of the Vacu-Break Clampmatic principle.

BullDog's Clampmatic Vacu-Break design combines in a simple construction the two features most essential to flawless safety switch performance—*clamp-tight contacts* and *easy operation.*

It is worth remembering that BullDog—with all its advantages of simplicity, fine appearance and positive action—costs no more than switches *without* this thoroughly modern design.

Ask your BullDog field engineer to give you his interesting mechanical demonstration of the Clampmatic Vacu-Break principle.

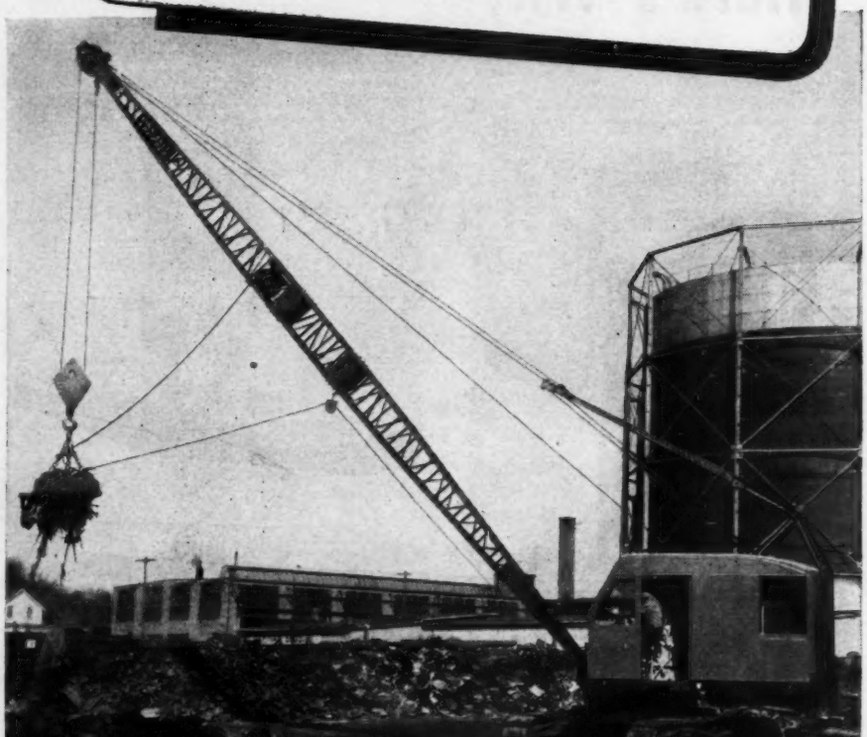
MANUFACTURERS OF a complete line of Vacu-Break Safety Switches, Panelboards, Switchboards, Circuit Master Breakers and BUStribution SYSTEMS.

BULLDOG
ELECTRIC PRODUCTS CO.
Detroit, Michigan

BullDog Electric Products of Canada, Ltd., Toronto, Ontario
Field Engineering Offices in All Principal Cities

For a bright future BUY MORE WAR BONDS

YOU HAVE NO MATERIAL HANDLING PROBLEMS WITH A LINK-BELT SPEEDER



You can load and unload, stack or move materials quickly and with a minimum of trouble when a Link-Belt Speeder is on the job. These machines are more flexible and easier to operate than other machines of similar sizes. To get the job done right and on time, use a Link-Belt Speeder.

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LINK-BELT SPEEDER

BUILDERS OF THE MOST COMPLETE LINE OF SHOVELS—CRANES—DRAGLINES

LINK-BELT SPEEDER CORPORATION, 301 W. PERSHING ROAD, CHICAGO, ILL.
(A DIVISION OF LINK-BELT COMPANY)

increasingly on wage incentive plans to keep our employees satisfied?"

3. *Government as "Personnel Man."* Denial of the right to strike by the Smith-Connally Act, wage increase limitations, and curbs on job-hopping in search of better pay make plausible the notion that government is now the "personnel man" to whom all problems can be referred. No *ersatz* form of wartime industrial relations has been invented to replace tried and proved industrial relations principles and techniques.

4. *Labor policy as a morale builder.* On the theory that morale is a lot of little things, in many concerns there is feverish activity with such devices as posters, slogans, music, movies. Important as these may be, they will never overcome the lack of a sound personnel program, fundamentals of which are (a) a profound good will toward employees, (b) expression of this good will in such basic forms as fair and equitable wages, adequate means for self-development and upgrading, careful observance of labor laws, maximum security, prompt settlement of grievances, proper hours and working conditions.

Such a policy, enhanced in significance in wartime, appeals to enduring motives, the things which lead men to exert their best efforts and give honest service—broadly, the non-financial incentives which are unspectacular but, like old friends, wear well.

5. *Management-Labor Cooperation.* Few of us foresee any reduction in union membership comparable to that following World War I. Acceptance of the mutuality of management-labor interest and responsibility and adoption of straightforward bargaining procedures may leave in management's mind the question whether labor will play its role with equal fairness. Dodd's answer to the question is, "Where management is open-minded and sincere, where it is willing to 'give and take,' it has been proved that labor, both organized and unorganized, will respond with equal sincerity."

In closing, he summarized the problems and conditions which he feels will claim chief attention in the months to come:

1. Curbing turnover and reducing the rate of absenteeism.

2. More planning for possible use of part-time workers.

3. Promoting the rapid integration of women, older people, and handicapped workers.

4. Greater use of Negroes and other minority groups.

5. Utilizing the training facilities of Training-Within-Industry and developing more effective company training programs to insure maximum utilization of skills.

6. Selecting and developing supervisors and executives.

7. Appraising top management's responsibility to foremen in the face of their possible unionization.

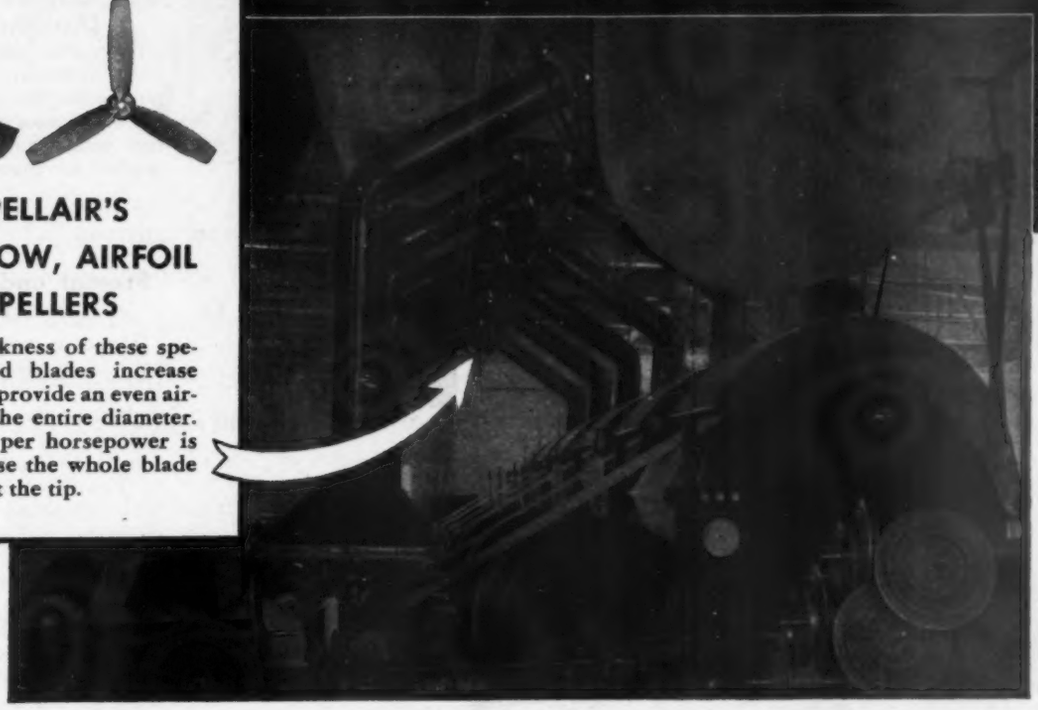
8. Promoting a constructive employee discipline.

9. Providing prompt consideration of

How PROPELLAIR BLADE DESIGNS Simplify Ventilating Problems

PROPELLAIR'S AXIAL-FLOW, AIRFOIL PROPELLERS

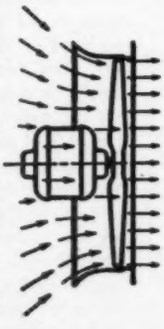
Pitch and thickness of these specially designed blades increase toward hub to provide an even airflow through the entire diameter. Maximum air per horsepower is attained because the whole blade works, not just the tip.



CURVED ENTRANCE RING

Another Outstanding Propellair Feature

As contrasted with ordinary straight-edge rings that serve merely as mounting devices, the Propellair Curved Entrance Ring helps the Propellair Fan to deliver more air per horsepower. This construction permits the utilization of the Airfoil air-movement principle in the entrance ring as well as the propeller, resulting in airflow that is at peak efficiency.



THE Propellair installation shown in this textile mill photograph offers a striking example of the manner in which Propellair blade designs solve ventilating problems, and of the remarkable economies which they effect.

In this instance the Propellair Axial-Flow, Airfoil blades use only a 3 h.p. fan load to do the work which required 32½ h.p. in a previous installation. Just six ½ h.p. extension shaft Propellair fans, operating in a vertical position, exhausting from slashers and size boxes are doing a better job than was formerly achieved by a 25 h.p. blower exhausting from slashers, plus a 7½ h.p. blower exhausting size boxes—an actual saving of 29½ h.p.

Entirely apart from the better results obtained, the big saving in electrical power and the proportionate reduction in operating costs are of real importance.

Whatever *your* war-production ventilating problem may be—whether it involves excess dust, fumes, heat or moisture—it can be solved efficiently and economically by Propellair ventilating experts and Propellair equipment. Mail the coupon for complete information.

Mail This Coupon Today!

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"Moving Air Is Our Business"
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PROPELLAIR, INC., Springfield, Ohio (21)

Please send me complete information on Propellair Ventilating Equipment.

Name..... *Position*.....

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My ventilating problem involves:

☐ Heat ☐ Fumes ☐ Moisture ☐ Dust

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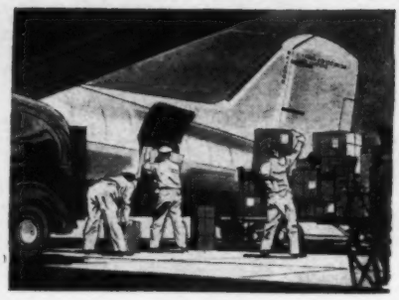
Air Express Rates Reduced



★ ★ ★ ★ ★ ★ ★ ★

Effective July 15th, Air Express rates within the United States were substantially reduced — many reductions ranging as high as 12½%, depending on the weight of the shipment and the distance it moves. As a result, the average saving to shippers amounts to 10½%.

Increased volume of Air Express traffic stimulated by wartime demands on this fastest form of shipping service—accompanied by peak efficiency in handling—has made it possible to pass these savings along to shippers of air cargo.

So now, more than ever, *it pays to ship by* AIR EXPRESS!

NOTE TO SHIPPERS: To keep costs down—*pack compactly*, obtaining best ratio of size to weight. To insure fastest delivery—*ship when ready*—as early in the day as possible. **ASK** for our new 1943-44 CALENDAR-BLOTTER. Write Department PR-10, Railway Express Agency, 230 Park Avenue, New York 17, New York.

AIR EXPRESS

Gets there FIRST

Phone RAILWAY EXPRESS AGENCY, AIR EXPRESS DIVISION
Representing the AIRLINES of the United States

grievances through a well-defined grievance procedure.

10. Enhancing the cooperative relationships between management and labor.

11. Developing non-financial incentives for all levels of labor and management.

12. Stabilizing wage levels, with special reference to the use of evaluation as a tool.

13. Sharing in the responsibilities for community, social, and racial problems.

14. Developing, as a continuous process, policies and plans with respect to post-war adjustments, including personnel requirements, the reemployment and retraining of veterans, gradual release of workers not permanently attached to the labor market, reconversion of skills.

* * *

Present and Future Manpower Problems

Immense economic and social changes have taken place since our entrance into the war. Upon the extent to which we understand these changes and adjustments depends our personal convictions concerning the immediate future, according to Lawrence A. Appley, vice-president, Vick Chemical Company, and deputy chairman and executive director, War Manpower Commission.

Pointing out that manpower needs and production loads cannot be predicted with accuracy over the same periods of time when a nation is fighting as when it is at peace, he stated, "The pattern of war does not remain static. You cannot have millions of men fighting under varying and changing conditions without having their needs change in terms of specifications, quantity, quality, and location. This influences manpower and production schedules, and every change in these schedules is felt in every community of the country.

"Eleven million men taken out of the production line to enter the armed forces create an obvious hole in the productive capacity of the country. What is seldom realized is that these eleven million men not only create a loss in production but also place a tremendous additional load on the production facilities of the country because of their far greater need in terms of equipment, supplies, munitions, and machines of war . . . It is impossible for any sane human being to conceive that we can supply men and materials for war and at the same time preserve, or even approximate, our civilian standards of living in peacetime."

In answer to groups and individuals who criticize the indefiniteness and many changes in program and activity, he said, "Nothing would delight us more than the possibility of telling every worker and employer in this country exactly what he might expect over the next three, six, nine, or twelve months. No one, however, has yet hazarded a prediction along this line which he is willing to support to the point of taking the full responsibility for the results upon the lives of more than 135,000,000 people.

"All manpower plans and estimates are

Common-Sense Economics

Few of us question the extent of the pent-up demand for goods that will follow peace in this country. It probably won't take very long for that demand to spread over the world.

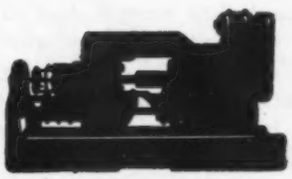
The natives of Papua are seeing, for the first time, "houses that fly". They are finding out that a bulldozer will clear more bush in a day than a thousand hand-wielded machetes. They have seen man-made ice that preserves food and cools drinks—on the equator.

Such things, and hundreds like them, we can make so good and so cheap that the people of the world can't afford to do without them.

It won't be much of a job to find ways and means for trading with the whole world, if we can make what this world wants good enough and cheaply enough.

That will be in part the responsibility of Acme-Gridley Multiple Spindle Automatics—cutting more metal parts, of higher quality, in less time, at lower costs.

Our own economic thinking and planning for the future is pointed in that direction.



ACME-GRIDLEY AUTOMATICS
maintain accuracy at the highest spindle speeds and fastest feeds modern cutting tools can withstand.

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OIL REGULARLY!

In these days of shortages we don't need to know how to choose a new hoist—but how to use an old one more efficiently, and how to make it last longer.

So—get busy with the grease gun! Where properly lubricated and maintained, many **WRIGHT HOISTS** have given constant, trouble-free service for 20 and 25 years. We have known other hoists to be so badly abused they were ruined in two years. Your **WRIGHT HOIST** will last indefinitely if you treat it right.

If your hoist is under constant use, as on assembly line work, inspect and lubricate it at regular intervals. If it is subjected to intermittent service, then perhaps lubrication every three months and inspection every six months is sufficient. But keep your load chain well-lubricated at all times. A well lubricated chain will far outlast a dry chain.

Conserve steel, protect machinery and maintain production schedules by regular inspection and lubrication.

In Business for Your Safety

WRIGHT MANUFACTURING DIVISION
York, Pa., Chicago, Denver, Los Angeles,
San Francisco, Portland, New York
AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT, CONNECTICUT

subject to changing conditions—casualties, physical standards required by the armed forces, production schedules, and requirements in relation to the materials of war, legislation, manpower needs of employers, dependency and occupational status of individuals, and so forth. The changes in most of these are influenced by military campaigns and needs. The test of success in manpower planning and administration is quick adaptability to changes as they occur or are imminent.

"In July, 1940, there were 9,300,000 unemployed in this country. Within the next few months there will be fewer than a million regularly unemployed and these will be unemployable. The regular labor reserve is gone. New resources have to be developed, and that which we have must be used to the greatest advantage in this war effort."

Voluntary Compulsion

To prevent the chaotic condition of government and private employers' recruiting workers where they please, the mechanism of War Manpower Commission voluntary stabilization agreements has been set in motion. "The National Management-Labor Committee of the War Manpower Commission has referred to these agreements as types of voluntary compulsion," Appley noted. "That may sound a bit facetious but it is extremely fundamental. If we are willing to write our own rules and are willing to abide by these rules, it is a much more pleasant form of self-denial than rules which are promulgated by others and forced upon us. The only enforcement behind such rules is honor and loyalty and, after all, what greater form of enforcement is there?

"Since the manpower situation in time of war requires individual sacrifices, there are no exemptions. If it is appreciated, therefore, that there must be restrictions upon both management and labor, it will likewise be appreciated that the nature of those restrictions and how they will be administered should be worked out jointly by all parties affected. How much longer will some of us fail to accept it?"

Intelligent Inventories

Convinced that the answer to the manpower problem is the finest industrial relations program a company can devise and put into effect, and that the war has been under way long enough for a sufficient number of tested practices and methods to have been developed without need for further experimentation and guesswork, he pointed out that thousands of employers have made intelligent inventories of their personnel and are no longer confused by manpower problems.

"If one shipyard can work with a force of which 37 percent are women and another shipyard has a force of which 3 percent are women, one of them is wrong," he declared. "If physically handicapped can be trained to perform certain skilled jobs in one industry, those with similar handicaps can do similar jobs in another industry. If one organization can increase its production and cut down its manpower requirements by intelligent super-

ONLY ONE WAY to correctly tension a stud or bolt!

Snap-on Torqometers

insure accuracy . . . tell tension as nut is tightened!

The only way to be certain of correct tension is to *know* the tension . . . accurately . . . as the nut is tightened. In many operations "guesswork" tightening can cause endless trouble. Snap-on Torqometers make precision tensioning as simple as reading a dial. Their use insures predetermined accuracy on fine assembly work, and prevents mechanical distortion in cylinder heads, bearings, steam flanges and transmission systems. As easy to use as an ordinary wrench. Their accuracy is no way affected when used with extension bars, universal joints, etc.

Snap-on Torqometers are available in a wide range of capacities, from 150 in. lbs. to 2,000 ft. lbs. Full information available on request. Write —

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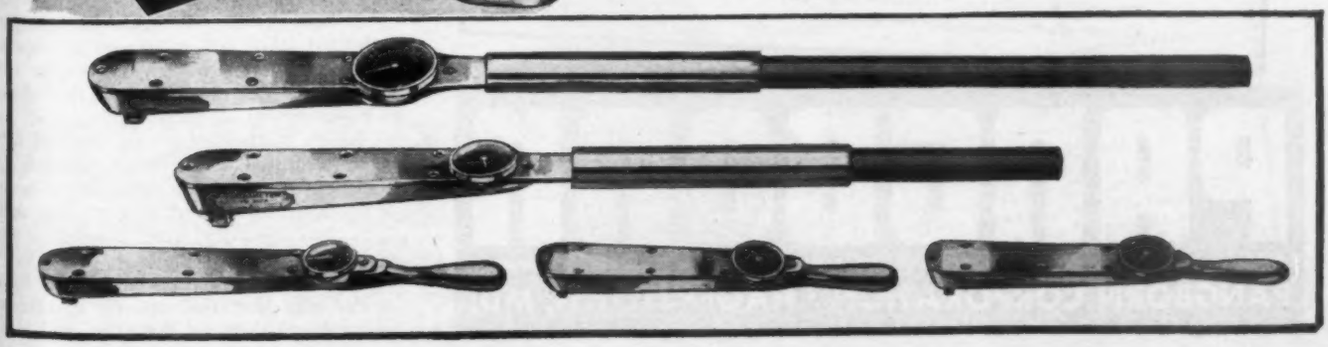

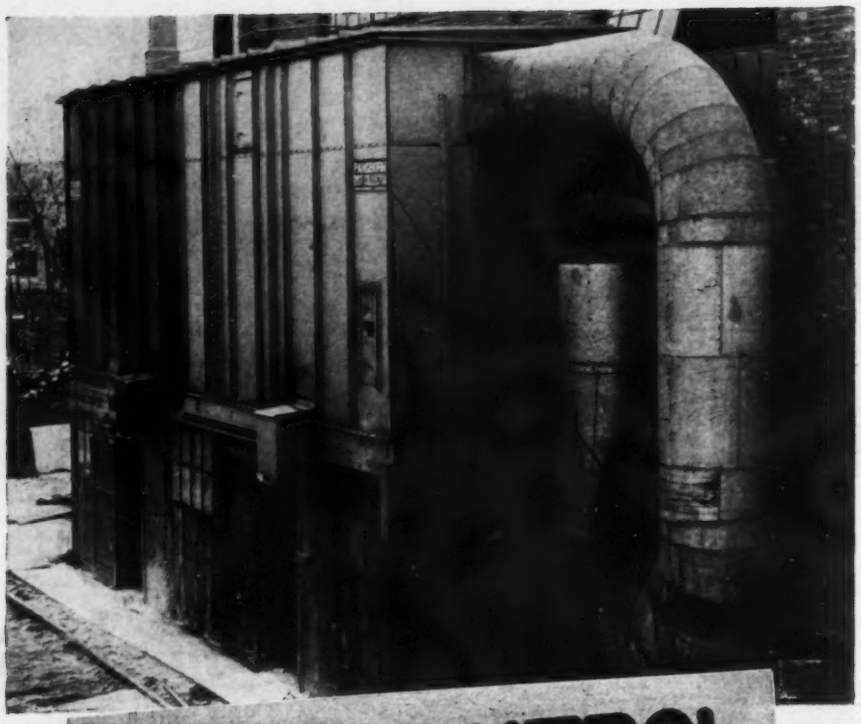

DUST CONTROL
MEANS ECONOMY
ON THE PRODUCTION FRONT

• Dust Control, effecting worthwhile savings in time, labor and materials, has been accepted as a great economy factor on the production schedules of modern industrial plants. The thirty-five years' experience and progress which give to Pangborn the leadership in the field of Modern Dust Control are successfully applied day after day—in almost as many different ways as there are industries.

• At a plant located in the heart of one of our great industrial cities—specializing in work which creates a vast amount of dust—effective Dust Control had long been desired but, in spite of extensive installations for the purpose, the problem could not be solved. Corrective results were recently achieved with a small Pangborn cloth screen Dust Collector which was installed in conjunction with the customer's entire collection system.

• Because of the outstanding success of this initial installation, the company decided to purchase the larger unit which is pictured above. After a short period, they equipped their eastern plant with similar collectors and have now ordered *four more* units for their main plant.

• This standardization on Pangborn equipment, based on actual operation experience, is proven evidence of the value that progressive management places upon the economy of effective Dust Control as obtained through Pangborn equipment and engineering service.

Send today for your copy of our new bulletin #909 which will help you to visualize the savings you *can* effect through Modern Dust Control.

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PANGBORN CORPORATION · HAGERSTOWN, MD.

visory and employee training, so can others. If one employer can cut down absenteeism and turnover through the use of certain carefully planned programs, other employers can do likewise . . . These things have all been done, have been done successfully, and have been done on a sufficiently large scale by a sufficient number of people to prove that they will solve manpower problems."

In conclusion, Appley stated that around these same concepts recommended to labor and management to carry out on a plant basis, the War Manpower Commission had built its program. All its efforts are being directed to the accurate determination of manpower needs, determination of manpower supply, and development of policies, plans, and actions required to get the supply to the need and keep it there.

* * *

The Plant a Social Institution

Lt.-Gen. George S. Patton, Jr., recently made the remark that in the formula for victory there must be leadership and there must be intelligent, enterprising following. Each problem must be solved with freshness and originality, and above all, the formula requires the highest degree of cooperation by all units.

Referring to this statement, Charles R. Hook, Jr., assistant to the president, Rustless Iron & Steel Corporation, observed the similarity between an army mobilized for military achievement and an industrial system mobilized for all-out economic achievement.

Aware of the need for recognizing a worker as an individual, he urged employee-management cooperation first and foremost as the expression of an attitude based on mutual respect, confidence, and understanding.

"Plants heretofore have not been regarded as social institutions," he said, "and quite naturally so, since the rise of industry as a basic social institution is quite a recent phenomenon. As a consequence, deep human wounds have been inflicted. The struggle between industry and labor, while unnecessary and debilitating to both, has occurred and great masses of employees now are banded together in unions for protection. Consequently, the employee attitude toward management and toward cooperative efforts in particular will be influenced by union policy and actions . . .

"I believe we would all agree that the unions are now one of the most powerful economic and political forces in the nation . . . The question that must be resolved is whether these two powerful groups, organized labor and management, should cooperate, or whether their interests are so dissimilar that cooperation in the future is impossible or undesirable.

"Much of the violence in the past has been predicated on the latter assumption, namely that labor and management were competitors for the national income and that their interests were essentially opposed in this competition.

"It is a false assumption. It is as false as the idea that the interests of officers and enlisted men are dissimilar and it is

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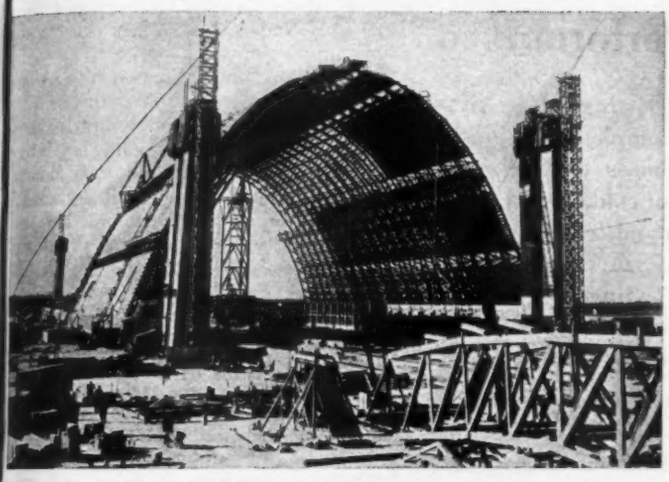
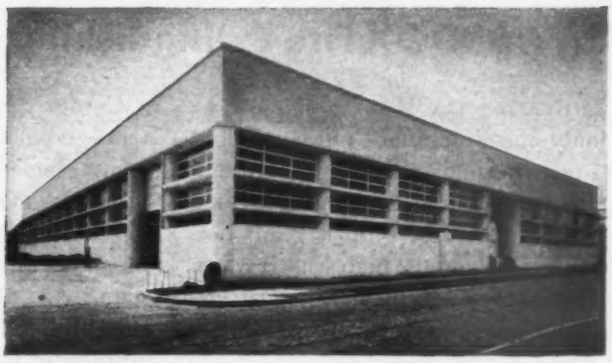
To this entire field Timber Structures, Inc. has helped bring *Engineering in Wood,* just as it did to plant construction before Pearl Harbor, just as it will do again for the postwar building certainties of industry.

Engineering in Wood is many things. Research, design, engineering, prefabrication, transportation, erection. All are part of Timber Structures service to plant management, engineers, contractors and architects. All are responsible for the construction speed, economy, strength and permanence of roof trusses and other timber structures and items supplied by this organization.

For today's *musts* and tomorrow's *certainties,* we are prepared to serve you in timber and other structural materials. Write or wire for any specific data on work under consideration. For informative literature on the jobs Timber Structures, Inc. has done, is doing, mail the coupon.



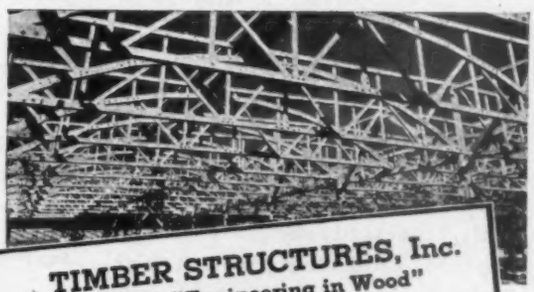
WORLD'S LARGEST TIMBER STRUCTURE. One of many similar blimp hangars for the Navy which Timber Structures, Inc. has fabricated and fireproofed. 1000′ long; 235′ wide; 185′ high. 2050 tons of steel were saved by Navy's use of modern timber design fabrication and treatment. TECO connectors and their use procedure as developed and made available by the Forest Products Laboratory and Timber Engineering Co., (subsidiary of National Lumber Manufacturers Association), helped greatly to make these structures economically possible in wood.

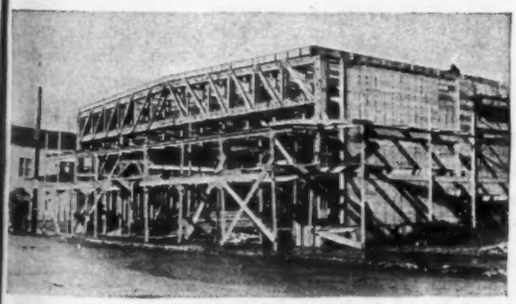


WAREHOUSE, 200′ x 300′ for Woodbury and Co., Portland, Ore. Roof is supported by 35-67′ trusses, constructed for 15 lb. dead load, 40 lb. live load, plus 14,000 lb. concentration at center line of bottom chord and adjacent to each end of the truss. Concentration supports a three-point suspended traveling crane used to handle steel plates, shapes and bars. Architect: Richard Sundeleaf, Portland. Contractor: Wegman & Son, Portland. Structural Engineer: Miles K. Cooper, Portland.

●

PLYWOOD PLANT, Peninsula Plywood Corp., Port Angeles, Wash. For this 265′ x 404′ building 90-64′ trusses were provided. Engineer: J. H. Stevenson. Contractor: A. S. Hainsworth Construction Co., Seattle.





MARKET for Safeway Stores, Inc., Gresham, Ore. Typical of Safeway Markets is this 60′ x 100′ concrete building with roof trusses by Timber Structures, Inc. Architect: Barrett & Logan, Portland. Contractor: Knott, Rogers & Dunbar, Portland.

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Beating the U-boat menace is only one—the final—phase in solving America's shipping problem. Before a battle wagon, flat top, freighter or troopship is ready for its vital job on the high seas, it must be convoyed through shipyard fire hazards.

Vital tons of shipping are serving the United Nations today that might still be only a hope except for Cardox Fire Extinguishing performance that guarded them against fire hazards during construction.

In addition, engineered applications of Cardox Fire Extinguishing Systems are playing a vital "convoying" role in war plants—large and small—producing such necessities as:

Airplanes, Aviation Engines, Aviation Carburetors, Airplane Parts, Engine Parts, Plastics, Rubber Products, Processed Fabric, Tanks, Tank Engines, Cold Strip Steel, Armor Plate, Forgings, Solvents, Motor Fuel, Electric Power.

Cardox Fire Extinguishing Systems give fast complete extinguishment. Timed, mass discharges of *pounds* or *tons* of cold, inert carbon dioxide smother and "cool out" large or small fires. Since there is no damage by the extinguishing medium, time out for repair of plant and equipment is reduced to a minimum.

In addition to producing individual applications of Cardox Fire Extinguishing Systems to protect a wide range of war industries, Cardox is working with industry on new improvements in fire protection to help build a better post-war world.

For further details, write on your company letterhead for Bulletin 1193.

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as dangerous as such an idea would be the midst of battle."

Turning to the question of taxes, declared, "The protection of profits fr being undermined by taxes must depe largely upon the development of a jo tax policy by business and organi labor designed to reduce taxes on pro to reasonable levels and to prevent creases in such taxes. Up to now the po ical policy of organized labor has be largely based upon the assumption th stiff taxes on profits did not fall on lab This assumption is grievously erroneo The willingness of enterprises to h labor obviously depends upon their jud ment of the chances that the return fro the venture will cover expenses.

Mutual Sacrifice

"Such an understanding of mutual in terest is the keystone of the bridg we must build from the turmoil of pre ent-day management-labor relations to o objective of genuine employee-manag ment cooperation. It is the vital 'comm goal' which General Patton placed 'abo all else.' And as he said, it is a goal 'worth of mutual sacrifices.'

"The fundamental reason for employe management cooperation is that it is pa of our democratic ideal. Industrial leade must realize that the plant has becom the basic social unit and that industria actions have social, as well as economi effects. We cannot, therefore, have tot democracy without industrial democracy.

* * *

Labor and Management Have Much in Common

The organized worker looks to govern ment to "balance" conditions which wi assure him of earning a decent, constantly improving standard of living and not to establish a system of political control o economic affairs. According to Robert J. Watt, international representative, Amer can Federation of Labor, nothing is fur ther from the wishes of organized wage earners than to establish a system of paterna alistic government.

"The soundest approach to the problem is that which relies most upon the demo cratic system of self-government by the democratically chosen representatives o organized management and labor," he de clared. ". . . It is the essence of the Bri ish system of industrial relations which was operating so smoothly at the outb break of the war that it could and did become the structure through which the British met the extreme dislocation and pressures of an economic mobilization, far more exacting than anything yet experi enced in this nation. Because they pro ceeded on a basis of cooperation, they at tained far more work for the worker and far more enduringly than the Popular Front in France, where the revolutionary Right and the extreme Left simply invited chaos and calamity.

"I'm afraid we have not been intelligent enough to realize that American trade and industry, America's system of com petitive capitalism, America's tradition of private property, and America's system

200 TONS PRESSURE!

Rodgers Universal Hydraulic Presses have been purchased by many large industrial shops equipped with large stationary presses. Engineers and shop superintendents recognize the advantage of having a powerful portable press to take to the repair job.

Ask your mechanic what he thinks of press equipment that can be used in any place and in any position where pulling, pressing or lifting power is needed. The Universal Press is portable and can be carried to the job and assembled around the work.

Illustrated below is a 200-ton unit, removing bearings and sleeves from pitman of a Diamond Iron Works Crusher, the job requiring 237 tons pressure. ***If it's a Rodgers, it's the best in Hydraulics.*** Rodgers Hydraulic Inc., St. Louis Park, Minneapolis, Minnesota.

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Serious shutdowns due to hard water problems can be avoided with properly conditioned water. Wherever water is heated, wherever soap or soda is used, wherever there is a boiler, you need conditioned water. Refinite softeners, filters, and other water-conditioning units will give you the conditioned water you need.

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Built of cantilever construction, of flat, die-cut sheet steel, formed and shaped with electrically welded joints to assure one-piece strength. Yet, designed to provide 90% efficiency—light in every direction without reflection or deflection!

The "Hoffcrafters" will take more punishment than they'll ever get in normal use—will withstand shocks of falling articles, being dropped, or kicked, without breaking! They offer protection against bulb breakage, afford extra safety for workers, and eliminate costly bulb replacement. *Pay for themselves, again and again!*

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free labor depend upon a basic unity between management and labor; and the realization, whether we like it or not, that labor and management have so much in common that joining forces is the only way to preserve a free system against termites from within.

"All we need from government is the foundation upon which labor can deal with management in a democratic equality of influence and initiative. Workers know that regimentation of labor is the essence of fascism at the outset, but the regimentation of industry is usually a very close and inevitable companion.

Working Together

". . . Most labor unions welcome the opportunity of working with management. Some unions take an over-optimistic view as to the extent of the opportunity which it creates. Too many managements resent any cooperation, or reject any participation, on the ground that joint collaboration means a sharing of the prerogative of management. The main handicap, however, seems to arise out of lack of understanding of the job to be done.

"We need to decide first how labor and management cooperation can be helpful. Presumably management is already rendering its maximum supervisory function and exercising its maximum resourcefulness, so that any net gain can be expected only from tapping the ingenuity, practical experience, individual sense of responsibility and collective self-discipline of the workers in the plant."

Referring to the general success of the labor-management committee experiment in which 2200 committees have been set up in war plants representing nearly five million workers, he saw the necessity for a live representative committee operating under a definite program in every war plant in the nation.

"We have to do it," he declared. "If we believe that management and labor organizations are not mere privileges, but also constitute rights which involve responsibilities, we shall set up a working partnership the nation over between management and labor. No matter how difficult the job, we must do it or risk the gradual crumbling of the system through which we know we have made greater progress than any other nation.

Pattern of Democracy

"A labor-management committee in every plant in the nation is the pattern of democracy in industry. It is the cure for bureaucracy. It is the mainspring of the initiative, resourcefulness, and self-discipline of free men . . .

"We have made mistakes in many ways. Most of our difficulties are due to failure to recognize the services which could be contributed on a voluntary basis by management and labor on a local, state, and national basis. There has been little recognization of the fact that there is great merit in democratic representation and in utilizing the work experience of wage earners which is just as essential to the operation of our system as the functions of management. We have failed to

The illustration shows two GRAYSON-KENNAMETAL 6" Half-Side Mills, with negative cutting angles, which milled heat-treated 4130 steel at a feed of 19¾".

"The use of KENNAMETAL steel-cutting carbide to "hog" through hard steels is old stuff in our shop; we have used only KENNAMETAL for machining steel since this carbide was developed. Now we have started to use the new GRAYSON-KENNAMETAL milling cutters and have been putting them through the most rigid tests possible, and the results are amazing.

"The other day I was going through the shop and stopped at one of the milling machines . . . and I was startled by what I saw. A Meehanite casting job which we formerly face milled with conventional milling cutters at a 4" feed per minute was now being milled at 30" per minute with the GRAYSON-KENNAMETAL cutters. Instead of a per tooth load of .001" to .003" as we generally expect, the load per tooth with these cutters is .003" to .016".

"How do these cutters stand up? . . . We formerly used high speed steel mills on this straddle milling job and milled 2500 parts per grind—now we are getting *35,000 parts per grind* with GRAYSON-KENNAMETAL cutters!

"The characteristic strength and hardness of KENNAMETAL added to the shock resistant Meehanite bodies of GRAYSON milling cutters have produced the most efficient milling tool we have ever seen in operation. Through use of these cutters we are now tripling our milling production on steel, cast iron, aluminum, aluminum-silicon alloys, brass, bronze, and non-ferrous metals."

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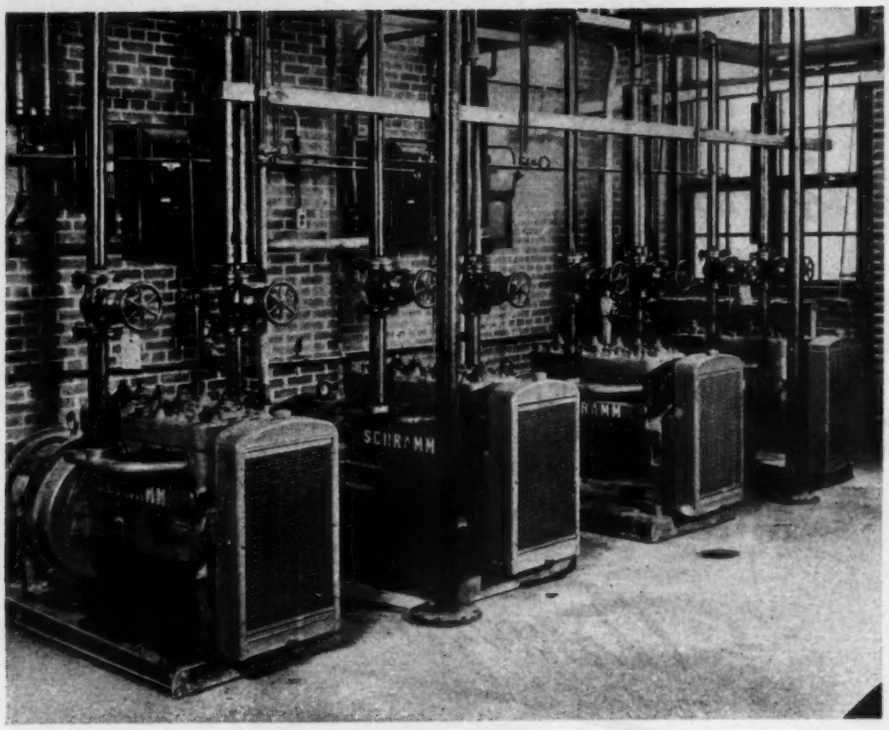

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Schramm was specified because it provides heavy-duty, continuous operation with least attention, upkeep and operating costs.

Schramm Air Compressors are available with various types belt drives, as well as built-in motor drive and direct connected diesel or gasoline engines. Each unit is lightweight, compact, with capacities up to 600 cu. ft. displacement.

Long-life features of Schramm include: mechanical intake valve... vertical piston travel and horizontal valve action... sturdy support for cylinder head... and forced feed lubrication.

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recognize that our system isn't working unless every unit has the brains, the energy and the intelligence to tackle every necessary job in its own backyard.

"I honestly believe," he concluded, "that this war of survival will bring domestic security and maintain political democracy only if we build and maintain truly representative committees and councils of management and labor which can and will bring discipline and self-government to trade and industry."

• • •

Management-Labor Education

Because many optimistic people are slowing up, waiting for the whistle to blow that the war is over, industry is again having to tighten its belt to keep production at peak. "Dangerous" is the word given by William L. Batt, vice-chairman, War Production Board, and president, SKF Industries, to the feeling of confidence and relaxation which is beginning to pervade the nation. Italy seems to be folding up, but she has had a comparatively small part in the war, and there are still some 8,000,000 well-equipped Nazis in the field.

In the past three years the country has overcome many material shortages and production bottlenecks. Looking ahead, the problem of the next months is manpower management.

"Turnover is appalling," Batt said. "It is not entirely a question of irresponsible workers; management must do more to arouse interest and loyalty.

"Never has the need for intelligent cooperation between management, labor, and agriculture been so great . . . Some managers have thought of some labor leaders as self-seeking thugs. The fact is that management can call forth and help develop the kind of labor leaders it wants . . . Management-labor cooperation is not a skill with which men on either side are born; it is an art to be learned. Management perhaps finds the greater difficulty in learning the patience and understanding needed.

"Post-war readjustments will call for equal understanding between management and labor. Relations to the foreign situation and reconversion both present problems . . . Management and labor have an equal interest in such public questions as spending money after the war to rehabilitate foreign countries, if only to build them up as customers . . .

"We can see who is going to win, but we can't say when . . . It is up to us all to re-dedicate ourselves to an all-out effort . . . I know of no better way of hastening the end than this rather unspectacular process of management-labor education."

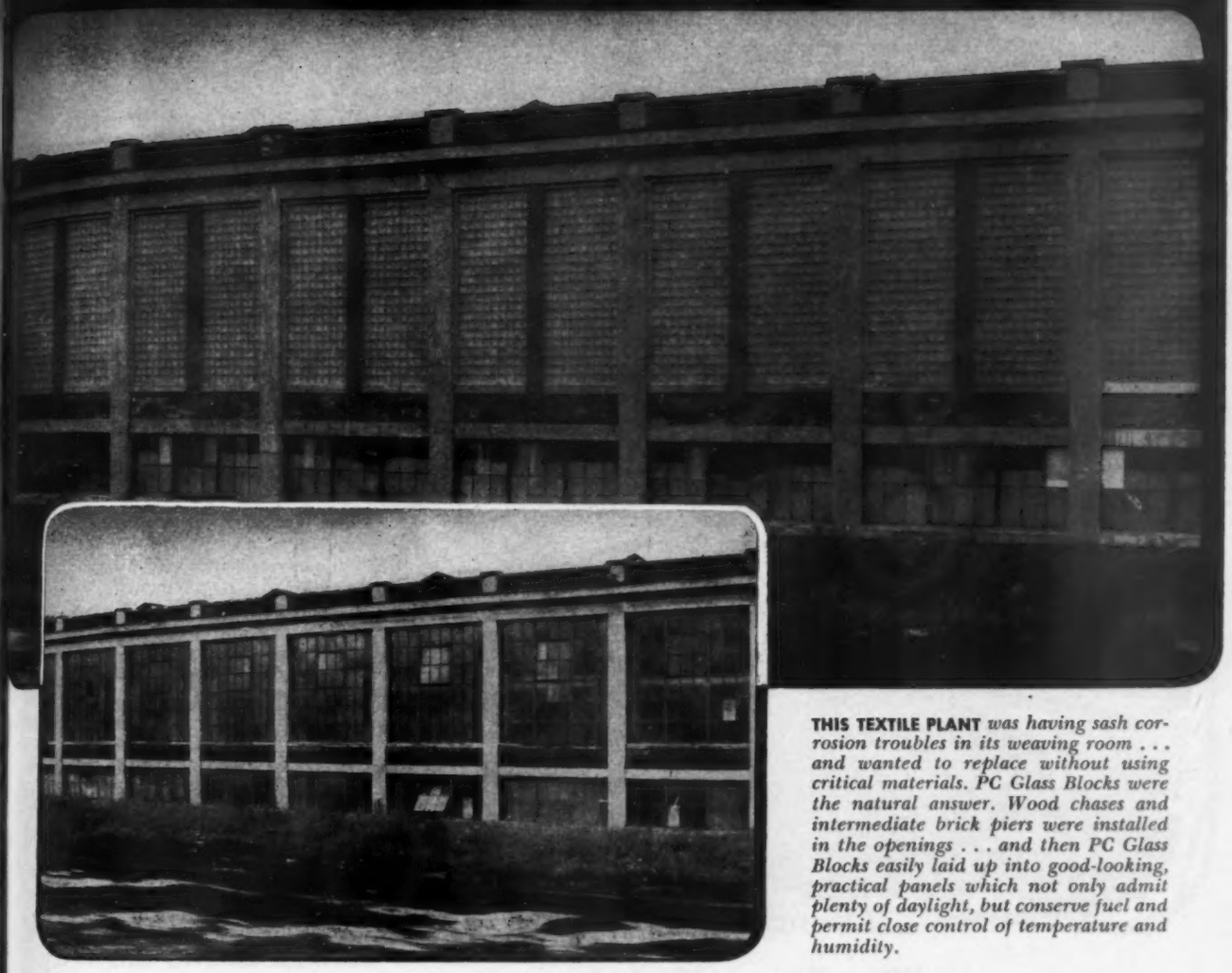
•

On-the-Job Training

The need for more and better training for men and women on the job is becoming increasingly apparent. Managers of war plants are being urged by regional

SASH TROUBLES?

CURE THEM WITH *PC Glass Blocks*



THIS TEXTILE PLANT *was having sash corrosion troubles in its weaving room . . . and wanted to replace without using critical materials. PC Glass Blocks were the natural answer. Wood chases and intermediate brick piers were installed in the openings . . . and then PC Glass Blocks easily laid up into good-looking, practical panels which not only admit plenty of daylight, but conserve fuel and permit close control of temperature and humidity.*

THE replacement of rotted, corroded or worn-out sash is quick nd easy when you do the job with C Glass Blocks.

No critical materials required. st take out the old sash. Install ew chases if necessary. And fill the penings with PC Glass Blocks.

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But they do more than provide an immediate answer to sash replacement problems. They also increase operating efficiency in many types of plants.

Here's why: they assure plenty of daylight inside the shop . . . they can even *direct* the daylight they transmit to areas far from outside walls. Their insulation value is twice that of single-glazed sash . . . which means they provide substantial fuel savings and permit temperature and humidity to be controlled within closer limits. This often produces a better, more uniform product, as well as reducing spoilage and rejects.

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Please send me your free, illustrated book that tells how PC Glass Blocks have been used successfully in many industrial plants.

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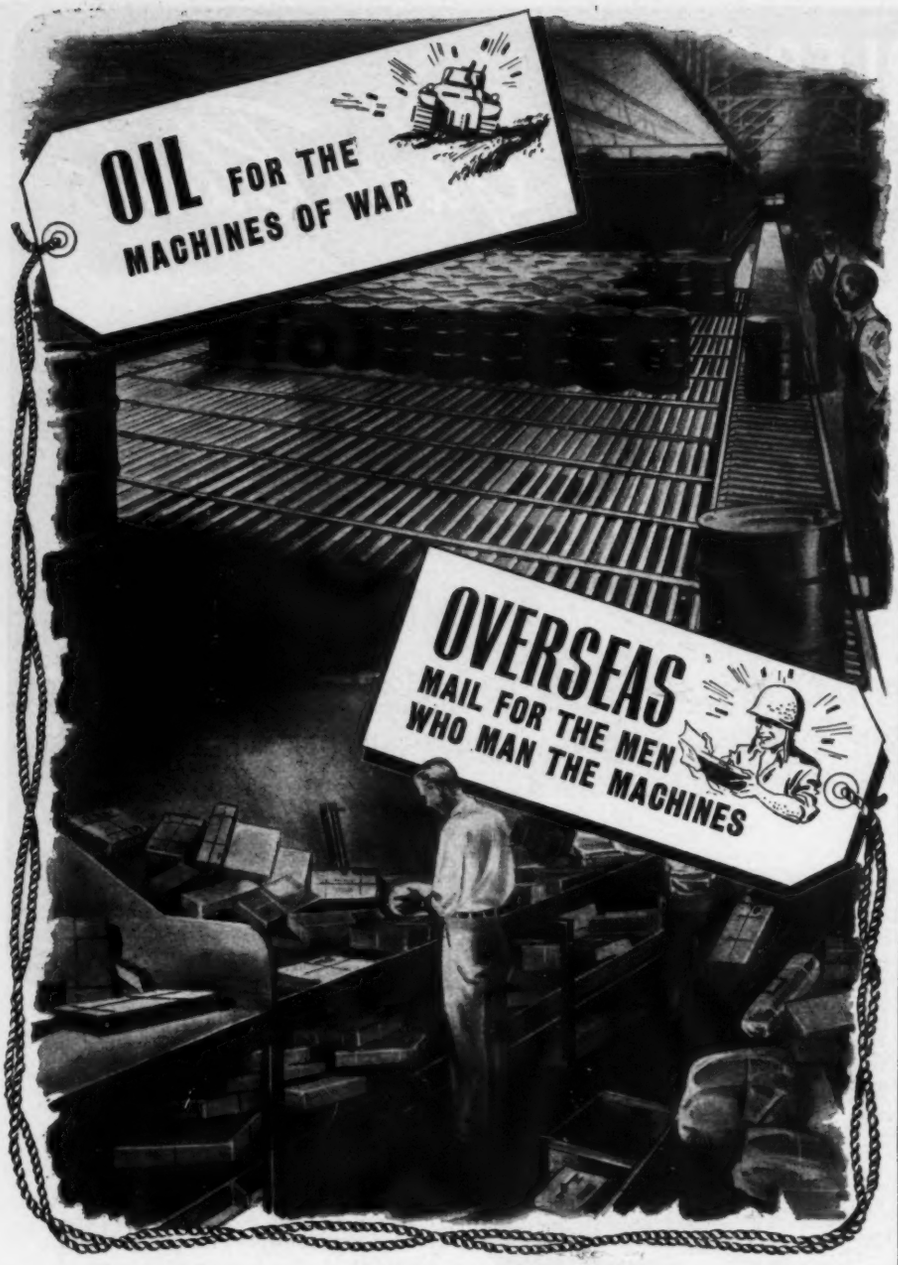
"PITTSBURGH" stands for Quality Glass



. . . When Time Is Vital
Standard Conveyors Expedite Handling

Oil is but one of many essentials of war whose handling is speeded up — in production and shipping — by Standard Conveyors.

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Whatever you make or handle now — or expect to in the future — Standard Conveyor Company has the "know how" for the building and use of power and gravity conveyors to your best advantage.

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directors of the War Manpower Commission to provide more training facilities for persons already on their payrolls. According to Chairman Paul V. McNutt, this action was taken because reports received by the Commission's Bureau of Training show a steady decline of enrollments in pre-employment courses, particularly in communities where labor shortages have become acute.

The Bureau's reports show that at the end of April, 1942, there were 104,000 enrollments in pre-employment courses in public vocational schools; in April, 1943, only 49,000, and in the following month, 41,000.

Although get-paid-while-you-learn training programs have existed in some companies since industry turned to war production, many have been ineffectively handled, McNutt said. Under the plan developed by the Bureau of Training, the regional or area director of the War Manpower Commission determines what training is necessary to increase production in occupations essential to war production. He also determines that there is no surplus of trained persons and that there is no assurance that trainees for unpaid pre-employment courses can be secured. The WMC director will then arrange for paid-training programs, using the public vocational schools, plant facilities, or other centers, with the interested contractor or subcontractor agreeing to pay the costs.

Trainees are men and women who meet employment requirements. Training is given under actual or near-actual employment conditions, with comparable pay, and with the same materials, machines, tools, and production jobs of the industry. The hours of work are the same as those of industry. Jobs for trainees are arranged in a carefully planned sequence so that they will progress from those tasks "easy" and "less easy" to those "increasingly difficult" and "difficult." Standards for the completed product are the same as those in the industry.

•

Britain Shows the Way to Full Use of Women

That American industry is not yet using its womanpower to the full is strongly indicated when the accomplishments of women in this country are compared with those of the women of Britain. In a small booklet put out by British Information Services, 50 facts about "British Women at War" are set forth:

1. Nine out of ten unmarried British women between the ages of 19 and 45 are in the uniformed forces, munitions factories, or essential war work.

2. One in four of the married women is employed in wartime industry.

3. Single women in Britain between the ages of 19 and 31 are liable to conscription for the women's auxiliary forces, but may elect to go into certain specified jobs in industry.

4. All women between the ages of 18 and 45 are registered for some form of national service.

5. British women with children of their own under 14 living with them, are con-

are on their way *with* NEW Speed Nuts

Every day bombers and fighters are assembled with more and more SPEED NUTS. The increased use of SPEED NUTS rolls them off the line faster and lightens them for added useful load. These approved self-locking aircraft nuts grip the screws with a DOUBLE SPRING-TENSION LOCK that resists vibration for the life of the plane.

The tons of metal conserved with the use of SPEED NUTS is almost impossible to calculate. And the man-hours assembly time saved runs into millions. Over 1500 shapes and sizes including many new ones just released. Approved for most all non-structural attachments by U. S. Army Air Forces and Navy Department Bureau of Aeronautics. Also used on trucks, jeeps and tanks. Write for our new book No. 185, illustrating some of our very latest developments.

TINNERMAN PRODUCTS INC., 2096 Fulton Road, Cleveland, Ohio

IN CANADA: Wallace Barnes Co., Ltd., Hamilton, Ontario

IN ENGLAND: Simmonds Aerocessories, Ltd., London

FASTEST THING IN FASTENINGS!

FIVE HINTS ON HOW TO MAKE

BETTER BEARING LININGS

Select the right bearing metal for the service, follow accepted methods of preparing the shell and pouring the metal, keep bearings well lubricated and free from dirt and your bearing troubles will become a thing of the past. While normal wear is to be expected, there is no excuse for cracked, squeezed and "frozen" bearings. The five points listed below have been found to be effective in helping to eliminate common causes of bearing failures.

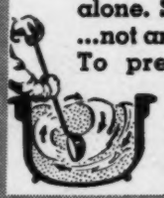
1

Bearing shell should be absolutely clean...free of old metal, oil, dirt, scale and rust. All anchor holes and grooves should be well cleaned . . . by hand if necessary.

2

Pour bearing metal at the correct temperature . . . the pot should be pyrometer controlled for best results. Use only new metal; addition of scrap of a different formula will change characteristics of the babbitt.

3



Babbitt metals are mechanical mixtures and tend to separate if left alone. Stir over and over ...not around and around. To prevent cooling of metal in ladle, have pot and bearing close together.

4

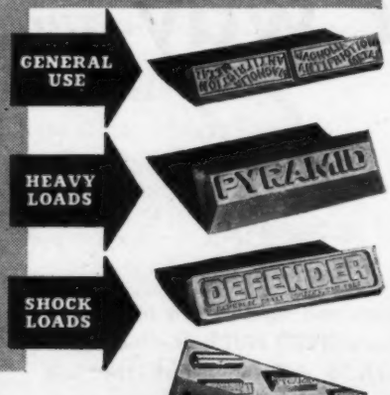
Use a self-skimming ladle . . . large enough to hold all the metal needed to pour entire bearing at one time. Pouring too quickly prevents air in mold from escaping and causes blow holes or seams in lining.

5

Most important point of all is selection of bearing metal. 90% of bearings in use today are subject to uniform speed and only moderate pressure, as in electric motors, line shafting and general machinery. For such services, use Magnolia Anti-friction Metal.

When bearings must stand heavy, sustained pressures, such as in rolling-mill machinery, use Pyramid, a hard metal which will not squeeze out.

For shock loads, which would crack the harder metals, use Defender, a tough yet malleable metal. Internal combustion engines and trap rock crushers are typical applications.



NEW BULLETIN

These and many other helpful hints are treated at length in our new 8-page bulletin. Why not write for a copy today . . . no cost . . . no obligation.

MAGNOLIA METAL CO. · ELIZABETH, N. J.

MAGNOLIA BEARING METALS

sidered as already doing work of national importance and are not directed to undertake other duties. Single women, or those without domestic ties, are considered as "mobile" workers, and may be ordered to leave their homes and go where labor is needed.

6. By the beginning of 1943, more than 2,000,000 women, some entirely new to work, others transferred from non-essential industries, had entered munitions and other key industries.

7. In the Royal Ordnance Factories in Britain, where guns, shells, and explosives are made, 60 percent of the workers are women.

8. In the iron and steel industry, 64,000 women, or 13¼ percent of the industry's employees, do 950 different jobs.

9. In the aircraft industry, 40 percent of the employees are women. On viewing and inspection work, 82 percent of the employees of one firm are women. Another firm has 90 percent on riveting. One firm replaced 500 men by 500 women in three months without any loss of output.

In All Fields

10. In the first three months of 1943 the number of women employed in Britain in marine shipbuilding—an industry in which there are great difficulties in employing women—was 37 percent greater than in the preceding three months. In some boiler shops women are working in 11 different trades. In one firm women take care of the complete assembly of oil coolers for diesel engines.

11. British women are trained for industrial work at government expense at 25 training centers and 150 technical colleges, in courses that last from five weeks to three months.

12. The greatest industrial reserve in Britain is among "immobile" women and those who can undertake only part-time work. Over 500,000 women have rearranged their household responsibilities to become part-time workers. Two part-time workers have been found to produce more than one full-time worker—often as much as 50 percent more.

13. In the first two years of war, women were recruited into British industry in unprecedented numbers and not to routine, unskilled tasks. Since 1942, they have been upgraded to key positions. There is scarcely any job in the production, maintenance, and repair of British aircraft, tanks, guns, or marine engines in which women do not play a vital part.

14. British professional women—architects, chemists, engineers, medical officers, lawyers, and scientists—have been mobilized for the war effort. There are 5225 women scientific assistants at the Ministry of Supply alone.

15. Behind the scenes at the British Ministry of Food, five women nutrition experts aid in the battle of food production. Women domestic science experts staff the Ministry's experimental kitchens for testing and producing new recipes for foods in plentiful supply, or for utilizing new types of food.

16. British women of good education with an aptitude for scientific or technical subjects, are given six months

ARMY'S MOST "POPULAR" ELECTRIC PLANT

This compact 2500 watt Portable, of which we have supplied MANY, is the Army's most "popular" Electric Plant. It's a front-line unit designed to supply juice when and where needed quickly. It's an ideal plant for miscellaneous portable use to keep in mind when U. S. Electric Plants are again available.

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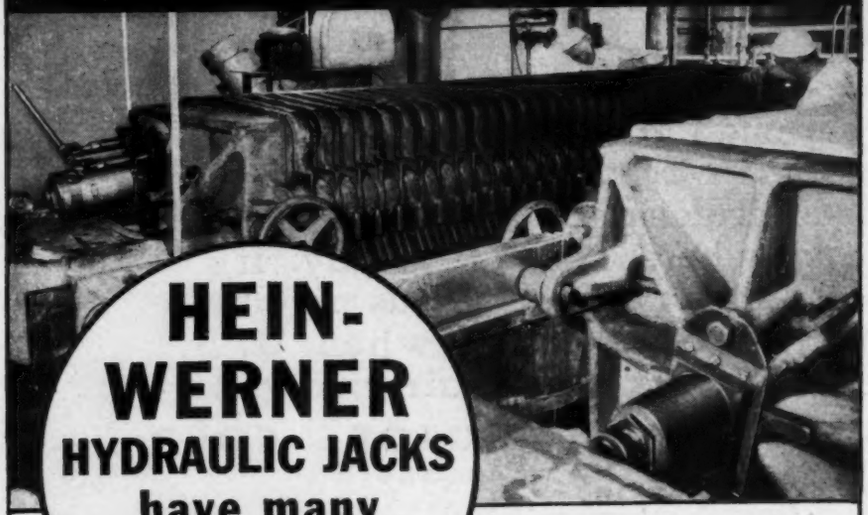
Oshkosh, Wisconsin

$2\frac{1}{2}$ KW
AIR-COOLED
HANDLES REMOVABLE

U.S. Electric Plants

DIESEL and GASOLINE

Does This Picture Give You An Idea?



HEIN-WERNER HYDRAULIC JACKS have many industrial applications

Dual Operation of Two Speed Pumps is an outstanding and exclusive feature of 30 ton model.

(Model 30.11A)

Perhaps you have never thought of the many uses you could make of a Hein-Werner Hydraulic Jack around your plant. Why not speed up war production jobs involving lifting, pressing, bending, etc.

Applications are almost unlimited. For example, note the use illustrated above. Here, a well-known leader in the dairy products field advantageously uses a 30-ton capacity Hein-Werner Hydraulic Jack on a 36" Filter Press. The presses illustrated, and two other H-W Jack equipped filter presses in this one plant, are held closed over four hour cycles under pressures up to 77,000 lbs. Now the job of opening and closing the filter press can be done by one man in 30 seconds, whereas two men required 10 to 20 minutes with the old method of gear and pinion.

The complete line of H-W Hydraulic Jacks includes super-powerful, easy-operating models of 3, 5, 8, 12, 20 and 30 tons capacity. Ask your industrial supply distributor, or write us for details.

HEIN-WERNER HYDRAULIC JACKS

Are Built Right and Priced Right

training at government expense and replace men as draftsmen, laboratory workers, and planning assistants.

17. Women students are admitted to the universities only if they intend to take up work of national importance upon receiving a degree. Those entering under the age of 18 may remain three years, under 19, two. Medical, technical, or scientific students may remain longer if necessary.

18. Care of children of war workers is looked upon as the government's responsibility. Provision had been made by the end of October, 1942, to look after at least 250,000 children while their mothers were at work.

Welfare Watched

19. The welfare of women factory workers is closely watched, special government training schemes at universities, with paid maintenance, have been instituted for social workers to become personnel managers and factory welfare supervisors.

20. The milkman, postman, the man who reads the gas meter, the truck driver and the porter—tens of thousands of them have been replaced by women. More than 105,000 women are working on the railways; 7000 women are bus conductors in London.

21. Over half the employees in the British Post Office are women.

22. Women between 17½ and 40 years of age are releasing men in the Army, the Royal Navy, and the RAF for combatant service by undertaking non-combatant duties in three auxiliary services—the auxiliary Territorial Service, The Women's Royal Naval Service, and the Women's Auxiliary Air Force. Members of these forces are serving overseas wherever British men are stationed.

The Auxiliaries

23. The Auxiliary Territorial Service, by far the largest women's service at the beginning of the war, has multiplied its strength more than ten times.

24. On anti-aircraft gun sites in Britain mixed batteries of men and women fight off the attacks of the Luftwaffe. To the women goes the responsibility of working out by the aid of scientific instruments where the gun is to be aimed; to the men, the job of firing the shell.

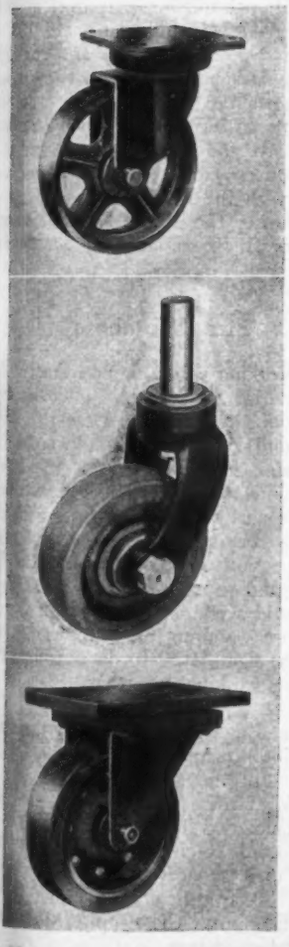
25. There are 63 trades in the ATS, and more than 80 percent of the auxiliaries are releasing men for other duties.

26. The Women's Auxiliary Air Force has expanded to 78 times its original size, and its five initial trades have increased to 65.

27. Women between the ages of 18 and 65 are attached as auxiliaries to the Home Guard, Britain's volunteer defense army of men ineligible for the regular fighting forces. They perform non-combatant duties such as clerical work, cooking, and driving.

28. In the Balloon Command, women of the WAAF are in complete charge of many barrage balloon sites. For every site manned by them at the beginning of 1942, there are now 19.

29. Though the duties of the WAAF



A Name to look for in
CASTERS

Institutions and industries have used COLSON casters for more than 40 years... casters built to quality—not to price.

Today we are producing more casters than ever and they are available to industries and institutions essential to the war effort.

Tomorrow — when VICTORY comes — COLSON will be able to supply casters to all of our customers again.

★ BUY U. S. WAR BONDS ★

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ELYRIA, OHIO

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DIXIES HELP SIMPLIFY EMPLOYEE FEEDING

The gigantic task of feeding thousands of hungry men and women on the job calls for speed . . . and many short cuts. A big, time-saving aid in this tremendous commissary job is Dixie paper service . . . Dixie Cups and Food Containers.

Pick-up and clean-up time is reduced to minutes with Dixies . . there is no breakage hazard, less noise.

Every worker is assured a safe, clean, never-used-before cup and container from which to enjoy his meal.

An Answer to the Help Shortage Problem

Dixies cut dishwashing to the minimum . . . enable less help to swing the job . . . with less effort and in less time.

COLD DRINK CUPS
for fruit juices, tomato juice, etc.

COLD DRINK CUPS
for milk and soft drinks, etc.

HOT DRINK CUPS
for coffee, tea, cocoa, etc.

FOOD CONTAINERS
for soups, stews, other hot foods

DESSERT DISHES
for ice cream, stewed fruits, puddings, etc.

Just in Case . . .
Uncle Sam's armed forces and high-priority war plants are using so many of our paper cups that we may not always be able to supply certain sizes you may want. We'll do the best we can. Uncle Sam must come first. We're sure you'd want it to be that way.

Dixie Cups and Containers are made at Easton, Pa., Chicago, Ill., Darlington, S. C., and Toronto Canada

DIXIE CUPS

ONE OF THE VITAL HEALTH DEFENSES OF AMERICA-AT-WAR

do not include piloting a plane, two categories of them actually fly—flight mechanics who test engines or equipment in test flights, and nursing orderlies in flying ambulances.

30. The Women's Royal Naval Service, though by far the smallest of the services, has grown from 1600 in September, 1939, to over 40,000 at the end of 1942. There are 80 different categories in which a "Wren" may serve.

31. The Wrens serve only on shore except for manning motor launches in harbor waters. They perform many of the same duties as the WAAF's.

32. Although members of the British women's services do not undertake combatant duties, they have frequently been under enemy fire. Many women have been decorated.

33. Women, 40,000 of them, serve in the Navy, Army and Air Force Institutes canteen service for the forces, and about 120,000 serve with voluntary canteen services for the forces.

34. Women under 35 are enrolled in the Royal Observer Corps where they do responsible work in the detection and notification of approaching aircraft. Often they are stationed at lonely, isolated posts.

35. In the British Civil Nursing Reserve, a wartime service formed to provide additional nursing personnel in time of need, 47,748 full-time and 18,000 part-time women workers are enrolled. They are attached to hospitals, first aid posts, in shelters or rest centers, and in reception area services. In nursing services attached to the Army, Navy, and Air Force, nurses are serving at home and overseas with the British troops.

36. During the Battle of Britain, one out of every six air raid wardens was a woman.

Fire Watchers

37. Working whole or part-time in the National Fire Service are 40,000 women. In each of the 11 Civil Defense regions of England and Wales is a woman fire officer who, in some cases, is responsible for as many as 5000 firewomen as well as many part-timers. Her duties include arranging for operational exercises, training, inspection of accommodations at fire stations, and supervision of the discipline, health, and welfare of firewomen.

38. Fire watching duty for women between the ages of 20 to 45 is compulsory for those working less than 55 hours a week.

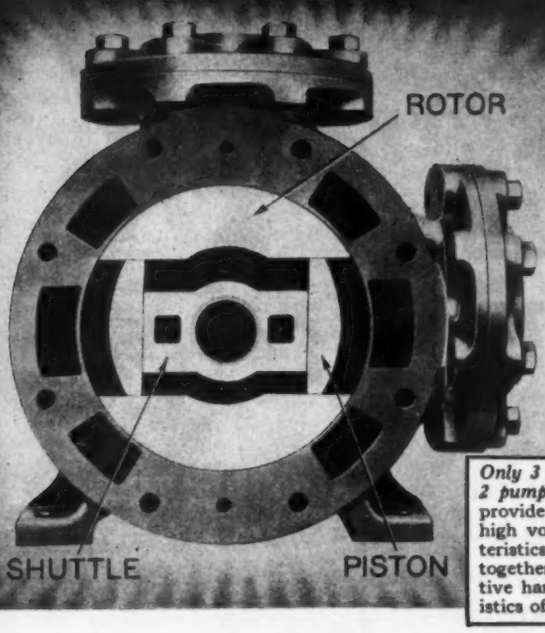
39. In England and Wales there are nearly 5000 regular and auxiliary police women. In the auxiliary service, they undertake mostly clerical work, and the maintenance and driving of cars.

40. Awards to civilian women and those in the civil services include 34 George Medals, 86 awards of the Order of the British Empire or the Empire Medal, and 173 commendations.

41. The Women's Land Army, numbering 5000 in 1939, has multiplied twelve times. Recruited from volunteers, mostly without agricultural experience, women from 17 to 40 are employed on farms, market gardens, and in forests.

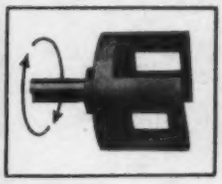
42. For women who are willing to

NO OTHER LOW PRESSURE PUMP Gives you these 2 POWER ECONOMY PRODUCT PROTECTION



Only 3 moving parts — 2 pumping members... provide the low cost and high volumetric characteristics of a rotary pump together with the positive handling characteristics of piston action.

IN 1 UNIQUE PUMPING PRINCIPLE!

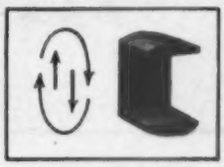


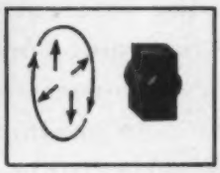
A ROTOR

Turning concentric with the shaft, is liquid tight fit in the housing. Designed with a channel across its face forming a double end square cylinder which holds —

A PISTON

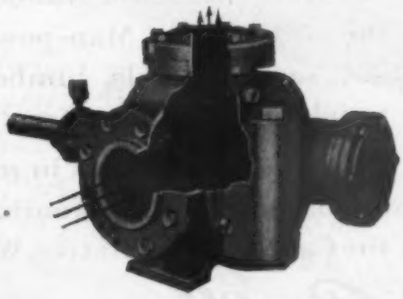
Of corresponding shape, which displaces liquid through openings in the side of the rotor and is formed as a channel to hold —





A SHUTTLE

With a hole in the center forming a bearing operating on an offset pin mounted in the cover. This discharges liquid through ports in the side of the rotor.



POSITIVE FLOW—When the rotor revolves, the offset relation of bearing pin to rotor shaft imparts reciprocating motion to piston and shuttle. These two pumping members acting by and in rotation, *positively displace* the liquid. Since rotor openings receive and discharge every 90 degrees, four pumping strokes overlap, and since the areas of shuttle and piston are equal, a smooth flow of liquid is discharged into the outlet line.

Many pumping problems have been solved and liquid materials today are being handled more efficiently, more economically, without waste and with less power by Yale & Towne's Rotary Piston Positive Displacement Pumps. Sliding piston action permits handling liquids of various viscosities without changing the clearances of pumping members or altering the thickness of gaskets.

Variable volume control — another exclusive feature of Tri-Rotor Pumps – eliminates relief valves, and, at a constant pressure, automatically and accurately adjusts displacement of material through the discharge ports in direct proportion to the eccentricity of the shuttle pin from maximum to zero capacity. This feature is optional for specialized installation where it is desired to eliminate heating, foaming, agitation and vapor losses of materials being handled.

Manual flow control, also optional, eliminates necessity for variable speed motors and converts the standard Variable Volume Control models into proportioning pumps of high accuracy.

An integral dash-pot relief valve, a bronze valve of special construction, is built into the head of the pump and permits discharge flow to be throttled from maximum capacity to zero, without shock or chatter. It provides all the advantages — including compactness — of a relief valve placed directly in the line. This type of head is so designed to be interchangeable with either the Variable Volume Control or our Standard Solid Head.

All of the above pumping units may be purchased as standard pumps or as mounted power-driven units with reduction gears, flexible couplings or V-Belt drives according to your requirements.

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PUMP DIVISION OF

THE YALE & TOWNE MFG. CO.

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The Yale & Towne Tri-Rotor Pump is now in use pumping such products as these:

☐ Gasolene	☐ Solvents	☐ Molasses	☐ Jam
☐ Lacquer	☐ Viscose	☐ Corn Syrup	☐ Coolants
☐ Paint	☐ Silicate of Soda	☐ Starch	☐ Fish Oil
☐ Varnish	☐ Glucose	☐ Ink	☐ Grease
☐ Caustics	☐ Liquid Soap	☐ Alcohol	☐ Shortening
☐ Oils	☐ Propane	☐ Edible Oils	☐ Chocolate

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Company.....

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Owing to present national needs for Yale Pumps, we cannot guarantee deliveries for some of the uses listed here. However, for post-war planning, mail this coupon now, checking product or service in which you are interested.

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EVER since the outbreak of World War II, Carey Products have aided in America's great battle of production by conserving Fuel and Transportation . . . speeding production of Aviation Gasoline and Synthetic Rubber . . . contributing to the efficiency of Man-power and Machine-power . . . saving metals, lumber and other vital materials in plant construction and maintenance.

If you have a problem in roofing, siding, flooring, insulation, or waterproofing, it will pay you to call the Carey representative. Write Dept. 31 for details.

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Dependable Products Since 1873 . . . Lockland, Cincinnati 15, Ohio

part-time work on the land near their homes, Emergency Land Corps have been set up in most counties in Britain. Through voluntary Land Clubs, other women spend their week-ends and holidays in farm work.

43. In the Women's Voluntary Service, 1,015, 921 women volunteers are mobilized. Originally organized to aid locally in civil defense, they now help with the work of 13 Ministries in jobs that include such varied tasks as driving mobile canteens, staffing rest centers for the bombed out, providing fresh vegetables for minesweeper crews, and sewing and mending for troops and evacuees.

44. Volunteer British housewives in three years of war, made over 4500 tons of jam, 120 tons of bottled fruit, 340 tons of canned fruit, and nearly 150 tons of pickles, which were sold to the public under the rationing scheme. During 1941-42 they picked 200 tons of rose hips to be made into vitamin-rich syrup for babies.

45. Half a million housewives in Britain received evacuees. Thousands more are sharing their homes with men and women of the Services and with industrial workers.

46. British women at home collect salvage for victory. In bones and kitchen waste alone their savings amounted to nearly 500,000 tons in the first three years of the war.

47. Of 750,000 voluntary collectors for Britain's National Savings Campaign, three-quarters are women.

48. In addition to their war work, British housewives must cope with the difficulties of stringent food rationing. Practically no food, save bread and flour (which must be wholemeal) and vegetables, is unrationed. Housewives have learned to cook potatoes in 200 different ways, to substitute dried eggs and milk for fresh, to do without cream, ice cream, salad oil, packaged jellies, iced cakes, or imported vegetables.

49. Women in Britain have learned to make do with their old clothes, and to repair and make over what they have. Twenty clothes coupons issued on March 1 would buy a girl a spring outfit consisting of a non-woolen dress, a slip, a pair of shoes, a pair of stockings, and a pair of cotton gloves. She would get no more coupons until August.

50. From the beginning of the war to the end of 1942 there were 101,311 civilian casualties in Britain; 18,667 killed and 20,998 injured were women, and 5904 killed and 4465 injured were children.

Magazine Acquaints Company and Employees

One solution to the problem of getting company news to employees is through the use of the company magazine as a "showcase." That is the way it is done at Revere Copper & Brass, Inc., Rome, N. Y.

"When a company is as large and complex as Revere," reports J. E. Walters, vice-president, personnel and labor relations, "it is inevitable that the majority of the employees will know little about it,

HANSEN HOSE CLAMPS

FIT ALL STANDARD HOSE SIZES!

Hansen Hose clamps can be used on all standard sizes of hose and are acknowledged as the outstanding hose clamps on the market. Their exclusive features tell the story of their remarkable performance and nation wide popularity.

Unlike ordinary hose clamps they have two grips instead of one . . . one on outside of hose, other on inside of hose . . . a distinct two to one advantage.

Compression grip — no tearing or cutting of hose.

Simple and easy to install, requiring no special tools.

Economical — can be used many times over.

Extra long stem . . . protects and prolongs the life of the hose.

Safe working pressure of 500 pounds.

Neat, trim and tailored.

Send for free catalog on Hansen Industrial Air Line Equipment

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INDUSTRIAL AIR LINE EQUIPMENT

AIR HOSE COUPLINGS • HOSE CLAMP SOCKETS • HOSE CLAMPS
AIR BLOW GUNS • HOSE CLAMP PLUGS • ENGINE CLEANERS
SANDBLAST CLEANERS • AIR-LIQUID SPRAY GUNS

Shorten the disability period with the new, faster-healing BIO-DYNE TREATMENT

NEXT to reducing accidents, themselves, your greatest concern is *reducing the time lost as a result of accidents* in your plant.

And that's why the newly-discovered *Bio-Dyne treatment for burns* is being so widely adopted in war-busy industrial plants throughout America.

For it has been demonstrated consistently in industrial burn cases, that Bio-Dyne Ointment *shortens* the disability period, gets men back on the job faster.

A new concept in healing

Discovered in a world-famous research institute, biodynes bring to science an entirely new concept in healing and tissue repair. They are neither hormones nor vitamins, but natural cellular substances which have the power to stimulate both the growth *and respiration* of living cells, resulting in:

1. More rapid healing
2. Almost immediate relief from pain
3. Prevention of scars where often they'd be expected

Write for detailed information on the new Bio-Dyne Treatment. Or mail the coupon, order a supply of Bio-Dyne Ointment, today.

BIO-DYNE Ointment

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Please ship by_____

_____jars 15-oz. Bio-Dyne Ointment at. . .$ 5.50 per jar

_____jars 5-lb. Hospital Size at. . . . . 21.50 per jar

Terms: 2%—10 days—net 30 days

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*Address*_____

unless a positive effort is made to inform them. Because many Revere employees seemed to think that the policies, processes, and background of the company were deep dark secrets of the 'inner sanctum,' we established an employees' magazine, the Revere *Patriot*, to serve as a 'showcase' in which to display Revere to its workers."

In the *Patriot* information is offered about new developments within the company, such as the awarding of the Army-Navy E; plant processes, as far as wartime regulations permit; plans for post-war development; the worker's part in the war effort; company history; and news of employee activities.

Necessary wartime measures are explained in the magazine to employees; the purchase of war bonds is urged in every issue, using many varied approaches and treatments; scrap salvage, ride sharing, anti-absenteeism, and similar drives are frequently stressed.

Morale Builder

"But," Walters points out, "an employees' publication must do more than merely educate the worker or act as a transmission medium for important propaganda if it is to hold the interest of its readers. It must also entertain, and it must build and sustain employee morale."

To hold employee interest and to stimulate mutual acquaintanceships among Revere employees, the *Patriot* publishes as many names as can be readily worked into the copy and as many photographs as space permits. Special attention is given to employee group activities such as baseball, basket ball, bowling, outings, and dances. When possible, one of the magazine staff photographers covers the event so that most of the stories are told largely with pictures and captions.

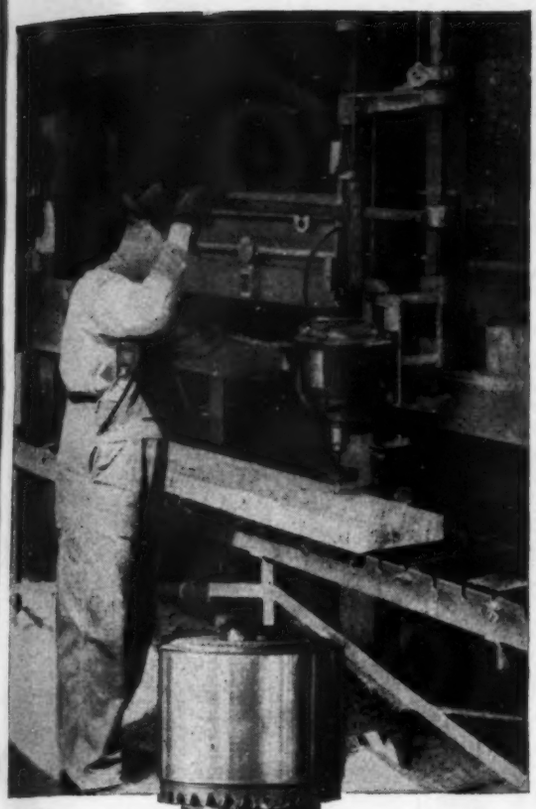
Human interest stories about unusual employees, their hobbies, accomplishments, or contributions to the war effort are featured frequently, as are articles about well-known company workers and their families.

How It's Done

With stories originating in eight plants located in five different cities, it was necessary to establish a more or less complicated news gathering organization. In every department of each plant, one or more department reporters have been appointed to gather news and relay it to a division editor. His job is to assemble the local news, prepare featurettes of divisional interest and see that the material from his division of the company is ready for publication when the deadline rolls around.

Copy then goes to the editor whose headquarters are in the general offices. There it receives its final editing and is layed out in pages. The editor also writes most of the feature stories which appear in the publication.

To provide each reader with the news which will be most interesting to him, and yet conserve paper and printing costs, the *Patriot* is printed in sections. Feature stories of company-wide interest are printed in a 16-page general section which



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✓ *Employ* a Teco Timber Fabricator

'Round the World—100,000 timber war and peacetime structures have been quickly and economically built with the TECO Timber Connector System of Construction—sponsored by the lumber industry since 1933.

The TECO Split-Ring Connector spreads the load on a timber joint over practically the entire cross-section of the wood . . . brings the full structural strength of lumber into play.

Write for FREE copy of "Heavy Timber Construction Details"—just off the press. Always specify TECO Connectors.

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NATIONAL MANUFACTURERS OF TECO TIMBER CONNECTORS AND TOOLS

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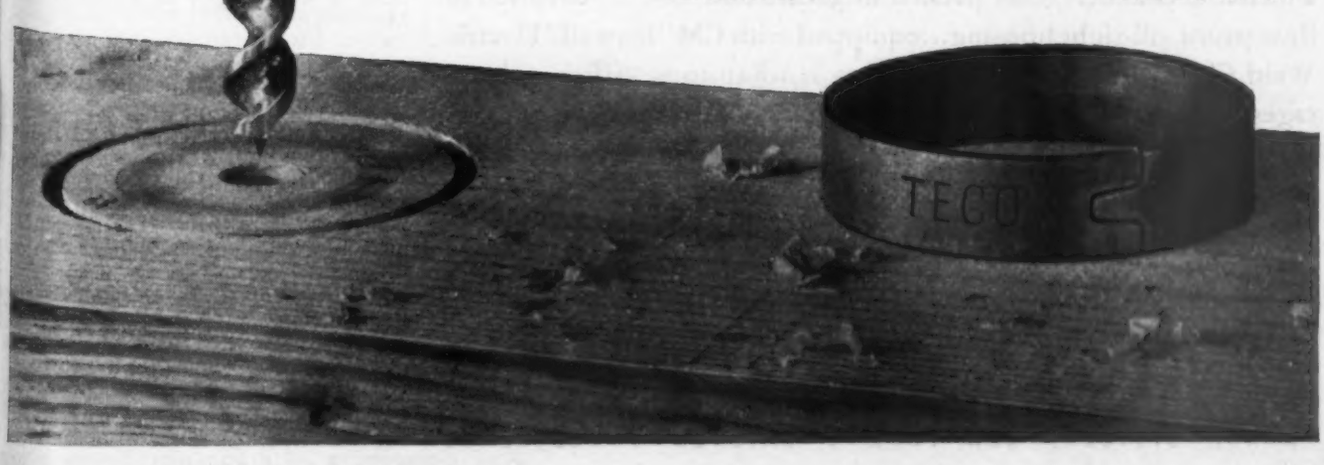

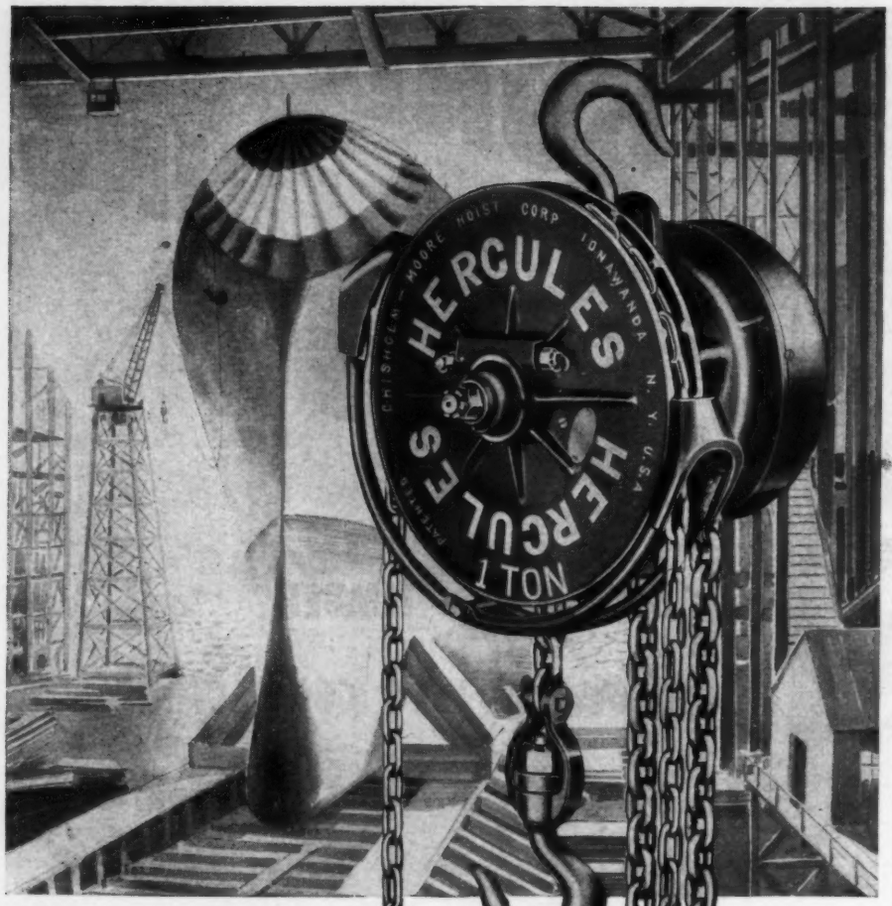

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TRAFFIC JAMS ARE OUT

In building the weapons of war and the trucks and ships that transport them, CM Hercules Hoists are contributing to new records in production efficiency.

The CM Hercules High-Speed, Spur-Geared Hoist is known in industry everywhere as the hoist that can "take it"...year in and year out. Features a shielded lift wheel ...load chain guides that prevent twisting or slipping... adjustable brake...gears packed in grease and enclosed in dust-proof, oil-tight housing...equipped with CM "Inswell" Electric Weld Chain. In load capacities from ¼ to 40 tons. All the advantages are detailed and illustrated in Bulletin 126E. Yours on request.

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forms the first and last eight pages in the magazine. News of divisional interest only is printed in local sections—one for each division—and these local sections are bound in the center of the publication. By this method, each employee receives all the general news, plus the local news of his own division. He does not receive the local news of the other divisions.

The *Patriot* is distributed by mail to all Revere employees and to former employees now in the armed services.

"Revere is so large," Walters stated, "and has its plants so widely separated that many of the close personal relationships possible in a small business have been lost and the establishment of an employees' magazine is simply intelligent management with a long-range viewpoint. A well-conducted company publication can foster goodwill and loyalty on the part of management, and weld both groups together with a bond of common trust and friendship. We feel that the 'Patriot,' our company 'showcase,' is doing its job well."

•

What the War Is Costing

Speaking in round billions, U. S. war expenditures have reached a figure which leaves a taxpayer's eyes bulging. From July 1, 1940, to June, 1943, inclusive, expenditures for war purposes by the United States Government amounted to $110,000,000,000.

Expenditures for war purposes for the fiscal year 1943 amounted to $75,100,000,000 or 2.7 times as much as the $28,300,000,000 expended in fiscal 1942, and 11 times as much as the $6,700,000,000 spent in fiscal 1941.

Expenditures for the month of June, 1943, alone were $7,688,000,000, an increase of $315,000,000 or 4 percent over May, 1943.

•

Post-War Lighting Exhibit

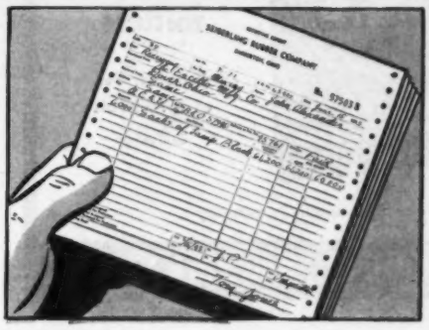
Of interest to those in industry who are already looking ahead to post-war production is a projected lighting equipment exhibition and congress. An annual affair, it will provide opportunity for manufacturers, wholesalers, contractors, public utilities, architects, and others to meet and discuss constructive developments and plans.

The exhibition will be sponsored by the Industrial and Commercial Lighting Equipment Section of the National Elec-

"Today's production battles can be won or lost RIGHT HERE!"

RECEIVING is the first actual step in production progress—when schedules hinge on needed materials or parts. Today, MORE incoming shipments, LATE shipments and PARTIAL shipments are burdening production with delays, confusion, errors and bottlenecked materials—unless the following essential elements *are present* in an adequate system of control . . .

SPEED: An efficient Receiving Report system permits checking and moving of incoming materials immediately. In typical Standard Systems, the original record speedily written on the spot is the final report; rewriting is eliminated and materials do not await transcribing of accumulated records before they can move to the department which requisitioned them.



INFORMATION: *Complete* information required by given circumstances, is provided for on a properly designed Receiving Report. Such a system will establish a definite routine for handling materials requiring inspection, or immediately clearing those not requiring it. Guaranteed consecutive numbers create an audit control and a tracer record.

NOTIFICATION: Handwritten or typewritten, a Standard System provides sufficient copies, all created at one writing, for prompt advice to Production Planning and all departments concerned. This includes proper supporting records for Accounts Payable, as to quantities, and acceptance or rejection—quickly clearing invoices for discounts.

57.14% of "Paperwork" Eliminated by Seiberling System

SEIBERLING Rubber Company is one of hundreds of leading American industries now deriving the advantages of simplicity, speed, and *control of material* provided by Standard Systems applied to their individual problems. Seiberling removed the constant threat of materials piling up with records incomplete, when they replaced a method requiring the original record to be transcribed by typist. A Receiving Report System handwritten on Standard Registers reduced 7 form-handling and writing operations to 3—a 57.14% elimination of operations.

You'll be interested in this case-story as one example of how basic principles of Standard's Systems (handwritten or typewritten) improve control not only in receiving but in all material control, production, shipping and other functions.

THE STANDARD REGISTER COMPANY • DAYTON 1, OHIO

On the Pacific Coast, address Sunset McKee-Standard Register Sales Company, Oakland, Calif., and in Canada, Crain Printers, Ltd., Ottawa, Ontario.

Standard Systems

OF INDUSTRIAL CONTROL

FORMCRAFT DIGEST D-152 explains the Seiberling Receiving Report System in complete detail, including the forms "before and after" and a Flow-Process Chart.

Standard is the originator, in continuous business forms, of these distinctive marginally punched holes which are Marks of Identity of the continuous forms of The Standard Register Company—"the Forms with the Punch."

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Please send me your Formcraft Digest D-152 describing the Seiberling Receiving Report System.

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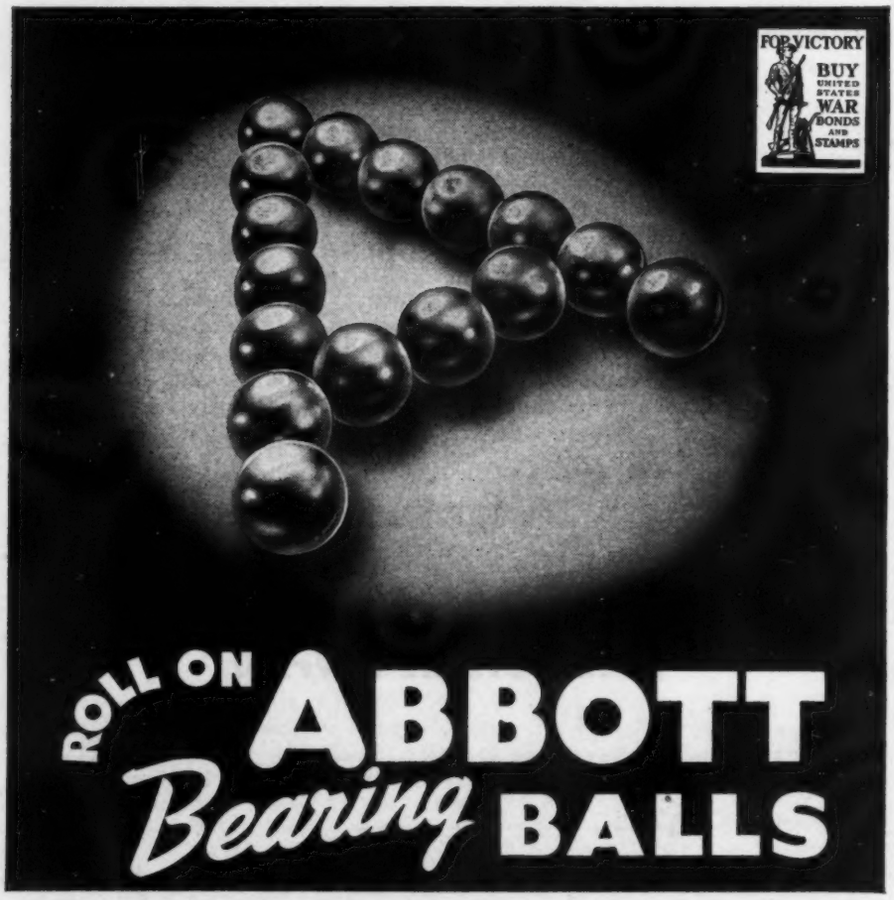

• THE ABBOTT BALL COMPANY • HARTFORD, CONN., U. S. A •

trical Manufacturers Association. Nine members have been named to make preliminary plans, looking toward the holding of the exhibition as soon as practicable after the war. Committee members are D. J. Biller, Day-Brite Lighting, Inc.; A. D. Cameron, Holophane Co., Inc.; M. M. Dunbar, Lighting Products, Inc.; Phil Litner, Bright Light Reflector Co., Inc.; W. P. Lowell, Jr., Sylvania Electric Products, Inc.; C. W. McDaniel, Fostoria Pressed Steel Corp.; G. T. Morrow, Curtis Lighting, Inc.; S. R. Naysmith, The Miller Co.; R. W. Staud, Benjamin Electric Mfg. Co.

•

Design for the Future in Industrial Relations

What the future relations of labor and management will be is a question in the minds of many leaders. Will their differences bog them down? Or will they come together on common ground and make the most of combined experiences and abilities? To foresee what type of industrial relations we are going to have and what types of policies should be adopted to meet those relationships, C. L. Huston, Jr., assistant to the president, Lukens Steel Company, Coatesville, Pa., suggested at the recent industrial relations meeting of the American Iron & Steel Institute that an attempt first be made to predict industry's probable environment. In his opinion, industrial relations is entering a new era. Although he refers specifically to the steel industry, his observations apply to industry generally.

Convinced that industrial relations policies must satisfy the fundamental desires of the workers and make them say, "This is a good place to work. I like it here," he stated, "Too often in recent years I suspect that all of us have allowed occurrences in the field of collective bargaining to obscure the need for giving sufficient attention to policies in the broader field of industrial relations. Some of us might have felt that the unionization of a plant has signified the failure of all earlier industrial relations policies and techniques. Those who felt that way failed to perceive that unionization perhaps fulfilled some fundamental desires of the workers not supplied by existing policies and/or the way they were administered, but that unionization did not necessarily constitute a repudiation of those policies."

He suggests that there is an opportunity for industry, if it will take advantage of it, to fulfill by its own policies and their administration the fundamental desires of the workers in such a way that no executive need asked the question, "Have we lost our men's loyalty to the unions?"

After the last war, industrial relations emphasized such developments as employee safety, health, recreation, and other welfare plans until the late 1930's, when collective bargaining became the predominant phase of industrial relations, and overshadowed welfare activities. "I suspect," Huston remarked, "that many

What's he got that you didn't have?

AMONG MANY THINGS already certain are endless human comforts made possible by plastics . . . shoes without leather . . . hats without felt . . . new kinds of suit and dress materials, as well as an almost endless number of home conveniences, that "neither moth nor rust doth corrupt."

You, perhaps, think of plastics as substances which can be molded into articles such as the toy in the child's hand . . . or into a telephone hand set . . . or colorful kitchen ware. But imagine beyond that. Imagine man-made materials which can be made as strong, pound for pound, as metal . . . or which can be spun as fine as the most delicate fibers. Imagine substances which can be made as clear as crystal . . . or as colorful as the rainbow . . . as elastic and flexible as rubber . . . or as rigid as stone.

Imagine materials which can be made acid-resistant or weather-resistant . . . shrink-proof, warp-proof, insect- or mold-proof. Imagine materials which are new substances in themselves, and which also transform familiar substances like wood, cloth, paper, leather, and even glass into new and more useful materials. Then you will begin to see what plastics can mean in the way of better houses, better cars, better clothes, better food containers . . . for your child . . . and for you.

The research which has characterized both BAKELITE CORPORATION and CARBIDE AND CARBON CHEMICALS CORPORATION, Units of UCC, has enabled them to show the way in the development and application of plastics and resins.

Resins and plastics, developed during the years before the war, are proving of extreme importance in essential activities of today. BAKELITE and VINYLITE resins and plastics help to insure the unfailing performance of battleships, aircraft, and tanks. They also extend the service life of military clothing and equipment, and hospital and surgical supplies. They are serving on all fronts.

These resins and plastics, and the new uses for them which are being developed today, will be important in the peace to come. They are among the things which will make a better world for you.

BUY UNITED STATES WAR BONDS AND STAMPS

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The Linde Air Products Company
The Oxweld Railroad Service Company
The Prest-O-Lite Company, Inc.

PLASTICS
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Did You Say
SPECIAL
Wrenches?
OTC specializes in tools for machine and plant maintenance . . . heavy duty box wrenches, pullers, push-pullers, giant slugging wrenches and special tools to order. At present, OTC commitments to U. S. Armed Forces allow only for high priority needs.
Write for Bulletin P. E. 1943.
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OTC
MACHINE MAINTENANCE
TOOLS
ARMY E NAVY
This OTC Marine Wrench is 6 feet long; has 12 3/16" opening, weighs 800 lbs.
HELP KEEP WAR PRODUCTION UP!

A Type to suit every
INDUSTRIAL NEED...
There are many uses for Halsey Taylor fountains throughout industry—and there are many types specifically designed for the purpose. In the shop wall, battery or pedestal types can be installed, and there are ice-coolers and electric coolers to suit your needs. In the office Halsey Taylor fountains are not only varied but artistic in design. Get our catalog.
THE HALSEY W. TAYLOR CO., WARREN, OHIO
HALSEY TAYLOR Drinking Fountains

important policies, unfortunately, were decided around one or two questions.

"These questions were: 'Will this help prevent unionization?' in non-union plants. While at plants under contract with the union, the question was: 'Will this cause trouble with the union or give it an advantage in bargaining?' . . . This period was marked by the breaking down and repairing of management's industrial relations fences."

In the future, he feels, a company will adjust its policies after answering such questions as "Do they satisfy a fundamental desire of the men?" "Do they help to increase productivity?" "Do they make the workers say—'This is a good place to work'?"

If employers will examine what a worker as a human being wants; if they pay fair wage scales; if they deal collectively or individually with their employees in an orderly, systematic way; if they dispel wrong ideas by frank information policies; if they properly train workers to perform their assigned tasks; if they provide job security as far as possible; if they encourage ideas and suggestions from all the workers, then they are facing a future of good industrial relations.

Organized labor, on its part, with hopes of a stable union movement, Huston assumes will permit no serious excesses on the part of extremists which will result in reactionary measures against unions and mean their subsequent rigid control.

Going on the basis that both sides will fulfill their responsibilities, he made several predictions for the future.

Forecast No. 1

"*Maintenance of Membership.* In all likelihood, we can expect the maintenance-of-membership contracts to remain in effect on the assumption that a reasonably high level of employment will be maintained. There have been no impressive indications that individual employees object to these clauses, and they will probably not object to them so long as their earnings remain fairly good. Certainly the union will fight any movement jeopardizing its security. It is difficult to imagine even a conservative government administration supporting the employer who tries to gain release from such a fundamental part of union security, which the union has enjoyed for some time and is willing to strike to retain. However, the trend already in evidence in certain state legislatures may lead to the institution of provisions in maintenance-of-membership clauses to insure the contract.

Forecast No. 2

"*Industry-wide bargaining* on a local or national basis was already being practiced before the war by (some) industries . . . During the war an impetus has been given to industry-wide bargaining by the War Labor Board's wage stabilization programs . . . In some of these cases, the body established by the Board to administer the stabilization agreement can deal with all types of labor disputes as well as with wage stabilization . . . It would seem logical that . . . (like) plants throughout the country who deal with the same union would eventually want to bar-

In PRESSES too—
HydrOILics does it better, faster, safer

The advantages of the DLSC2 HydrOILic Press, for numerous straightening and assembling operations, are typical of Denison's entire line. Stroke and pressure limits can be set if desired, yet *exact tonnage* required for each task is available *without* adjustments . . . movement and power-effort of the ram are fully controlled by the hand-lever or foot-pedal control. Upon release of the control lever, the ram returns at once to full-daylight, or pre-set, opening, and is positively held . . . there's no "drift." For safety, the DLSC2 is fully enclosed, free of projections, and has ample toe space for sure-footed access to the work-area. Capacities: 25, 50, 100 and 150 tons.

Operation is extremely simple. The ram is held in place hydraulically when it reaches the upper stroke limit, and the pump and motor idle, using minimum horsepower. Downward movement of the control lever causes the ram to move downward at rapid traverse speed, exerting minimum tonnage until it contacts the work. Further downward movement of the control lever increases the tonnage in direct proportion to the pressure exerted on the lever. Upon release of the control lever the ram returns immediately to the pre-set upper stroke limit, or to full-daylight opening. All principal moving parts operate in a bath of oil, reducing wear and maintenance costs.

THIS FREE BULLETIN contains full details on the Denison line of HydrOILic Presses for assembling, straightening and bending operations. Write for your copy today!

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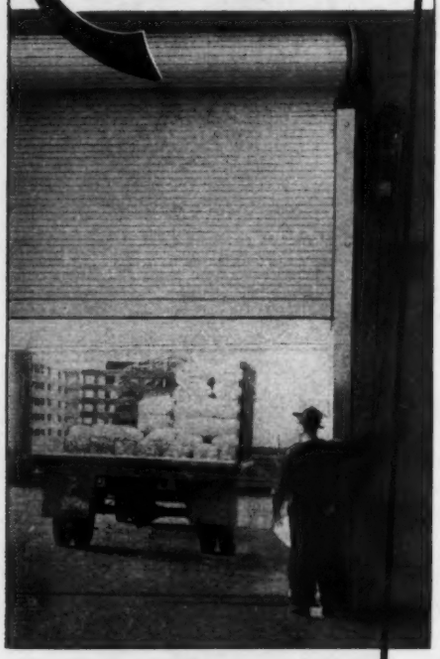
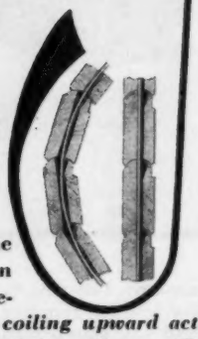
DENISON EQUIPMENT *in* APPLIED HydrOILics

DOORS THAT SAVE SPACE, TIME and METAL



KINNEAR *WOOD* ROLLING DOORS



In spite of wartime limitations, you can get efficient, space-saving doors with *coiling upward action*—Kinnear WOOD Rolling Doors. Their durability and service have been thoroughly proved on numerous installations for many years!

Constructed of strong, inter-lapped wood slats, they coil out of the way above the opening, remain out of reach of damage, and require no usable floor, wall or ceiling space for either storage or operation. They offer a high degree of protection, and block out wind and weather. The illustrations show how the rugged curtain is assembled, and how it permits the door to flex without binding. Kinnear Wood Rolling Doors are available in any size, with motor, manual or mechanical operation. Write for complete details! THE KINNEAR MFG. COMPANY, 1540-60 Fields Avenue, Columbus 16, Ohio.

Offices and Agents in Principal Cities

KINNEAR ROLLING DOORS

gain as a unit with that union. We seem headed squarely to the same practices in bargaining that have long been followed in Britain and Sweden.

Forecast No. 3

"*Unionization of Foremen.* The reversal of the National Labor Relations Board's decision on organization of foremen may diminish interest in this question. However, the fact that organization for this group became an issue at all points up for management the advisability of making certain that foremen are well informed and realize that they are part of progressive management . . .

Forecast No. 4

"*Grievance Procedure.* As time goes by we are going to regard the grievance procedure as an opportunity to get better acquainted with the desires of (workers) and those of the union . . . We should expect settlement of petty grievances in the early stages of the grievance procedure, and that the joint sessions of union and management representatives will spend more time on policies and plans for improved overall industrial relationships.

Forecast No. 5

"*Selection and Training Procedures.* With the application of contractual promotion, lay-off, seniority, and discharge provisions throughout the industry and the adoption of experience rating in unemployment insurance laws in an increased number of states, there is a clear trend in the direction of more stabilized employment and reduction of turnover. The steel industry is already giving . . . close attention to selection and training procedures. In addition to normal interviewing and personal record practices, increasing emphasis is being applied to aptitude tests, more comprehensive medical examinations, improved personal records, and merit rating systems. Training activities are becoming more definite and detailed in their objectives. Training staffs may be counted on to work more closely in coordination with employment, industrial engineering, and regular supervisory staffs to make the most effective use of manpower and make the worker more satisfied by putting him on the right job for his interest and talents and then developing those interests and talents to the fullest extent possible.

Forecast No. 6

"*Job Evaluation and Wage and Salary Administration.* The proper classification of skills for production and maintenance jobs and for salaried positions is receiving increased attention . . . Upgrading will be conducted in as scientific a fashion as possible, and the individual employee will be provided with a clear picture of his normal line of promotion. In all elements of wage and salary administration, the desire will be to eliminate the causes of friction and to include the combination of factors needed to insure fair recognition of merit and experience . . .

Forecast No. 7

"*Employee Safety, Health, and Security Policies.* Enactment of cradle-to-the-

ready-made skills *for trainees*

THE BEGINNER, like the veteran, merely peels off the .003 or .002-inch thick laminations to make the required accurate fit . . . A Laminum shim places precision in any man's hands!

Shims cut to your specifications. Stock shim materials obtainable from your dealer. Write us for further information and shim application chart.

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THE SOLID SHIM THAT peels FOR ADJUSTMENT

"AUTOMATICS"

All of us are working for a quick victory

★ You in your way—we in ours—are extending ourselves to the limit to shorten the road to victory.

It is obvious that materials handling is a most important part of the war effort and to us is assigned the task of getting materials handling equipment to those places where it will do the most good.

Naturally we regret the situation that makes it necessary for so many of our customers of long standing to be denied new "AUTOMATICS" for the present. Yet, all of us are happy to cooperate in our own way for in this united action comes victory. One of these days there will come an end to the "for the duration" period and "AUTOMATICS" will again be available. Meanwhile, since we are "all out for war production" and your victory efforts too are being contributed—keep your "AUTOMATICS" going to keep materials flowing.

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MANUFACTURERS FOR OVER THIRTY FIVE YEARS *Electric Propelled* INDUSTRIAL TRUCKS

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LIKE OPENING YOUR ROOFS *to the Sky!*

gives you large-scale building exhaust *at Low Cost!*

Your overcrowded war-busy factory buildings need more ventilation — to give workers a better chance to produce at capacity. Get quick relief with this efficient, economical, easy-to-install ventilator. As wide as your roof, if you need it, but never more than 32" high.

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grave social security has been proposed for the early post-war years. Its enactment, however, by no means argues for the elimination of company safety, health, and security plans. Regardless of what the government may or may not do, it is still the opportunity and even the obligation of companies to offer employees the personalized types of services that make them feel theirs is a good company.

Forecast No. 8

"Company Information to Employees and Community . . . In the future more and more companies will undoubtedly adopt carefully thought-out and expanded information programs to explain to employees and the communities the companies' policies and the how's and why's of their operations. Furthermore, an increased number of concerns will probably utilize attitude surveys to ascertain whether the information they are sending out is getting over to the employees."

•

One-Third Rule Affects War Housing

Regulations controlling the sale of privately financed war housing have now been liberalized by a modification of the joint declaration of policy of WPB and the National Housing Agency.

A builder may now sell up to one-third of the total dwelling units in all projects which he has placed under construction in any one war housing area under WPB priorities applied for on or after February 10, 1943. This is possible under amendments to NHA general orders which have become effective following WPB concurrence of the modification proposal.

Remaining units, which must be held for rental, may be sold to eligible war worker occupants after two months' rental occupancy, at the option of the tenant.

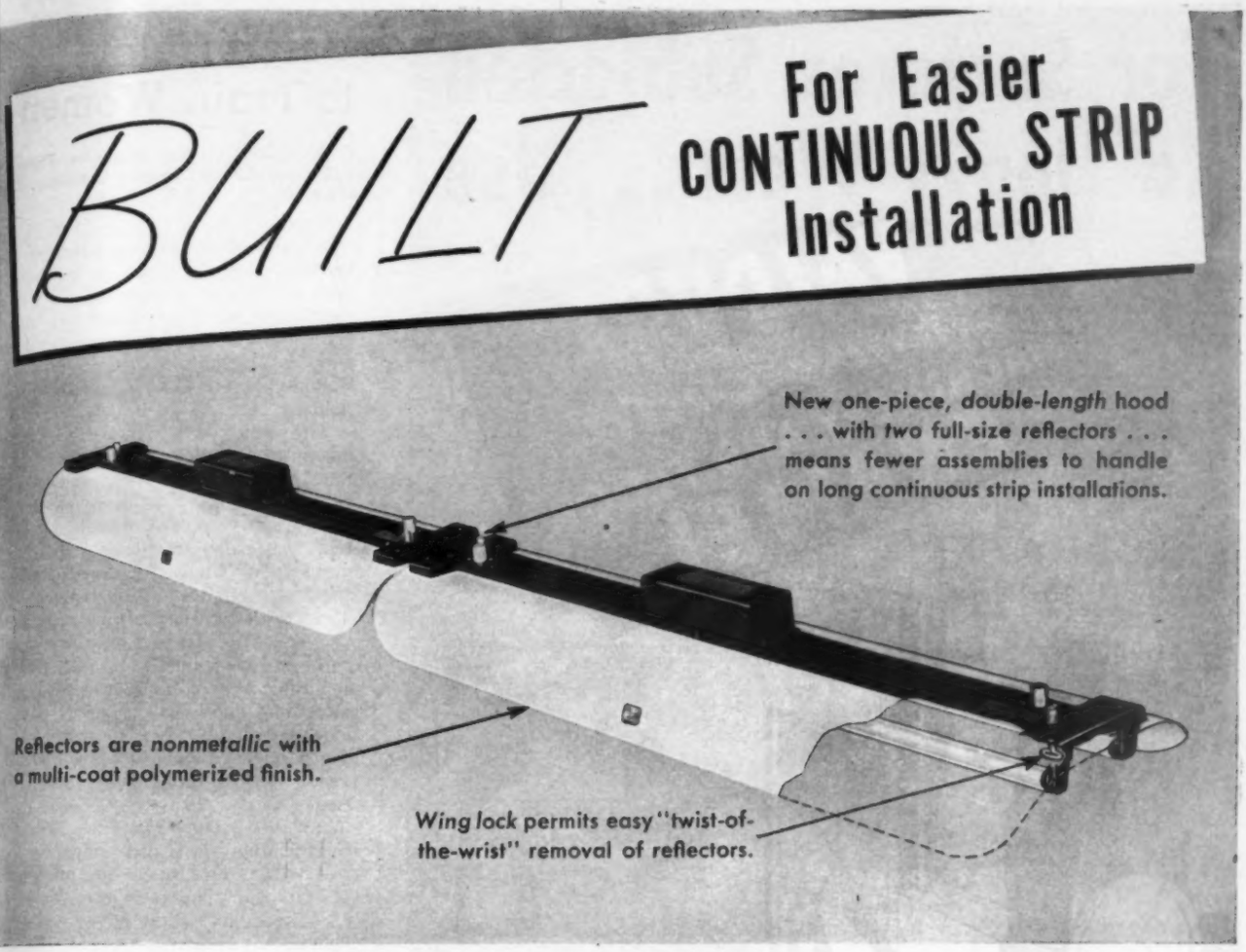
Previously it was required that all privately financed war housing built under priorities applied on or after February 10 be rented for four months before sale was permissible at the option of the occupants.

According to John B. Blanford, Jr., NHA administrator, the amendments were made in the light of operating experience. "Without sacrificing any of the objectives of the war housing program, the amendments are designed to stimulate privately financed production of war housing up to the full quota allotments and to reduce correspondingly the necessary need for publicly financed war housing," he said.

The amendments do not alter the requirement that occupancy of privately financed war housing built under priorities applied for on or after February 10, whether on a sales or rental basis, be reserved for eligible in-migrant war workers for the duration of the emergency.

The amendments also permit an eligible in-migrant war worker to apply for priorities to build his own house for personal occupancy. To obtain approval, however, the war worker must submit satisfactory evidence to the FHA that he has the *bona fide* intention and capacity to build and is not trying to circumvent the rental requirements on war housing.

BUILT For Easier CONTINUOUS STRIP Installation


New one-piece, *double-length* hood . . . with *two* full-size reflectors . . . means fewer assemblies to handle on long continuous strip installations.
Reflectors are *nonmetallic* with a multi-coat polymerized finish.
Wing lock permits easy "twist-of-the-wrist" removal of reflectors.

A New *LIGHT-WEIGHT* Luminaire For War Production Illumination

Westinghouse Continuous Strip Fluorescent Lighting can now be installed *quickly,* and *economically,* to help speed production of vital war materials. With this new Double-Reflector Luminaire, the only one of its kind on the market today, installation costs are considerably reduced—because you have fewer assemblies to handle.

This luminaire comes to you completely assembled, and is the equivalent of *two* conventional Fluorescent Units. The hood (or chassis) is of one-piece, all steel construction. While conforming with General Limitation Order L-78, it is rigidly built—capable of supporting a weight of 125 pounds at any point. New sliding hangers permit suspension from any part of the hood.

The moisture-resistant, nonmetallic reflectors are covered with a multi-coat, polymerized finish which provides a reflection factor of 85% or more. And it requires only a "twist of the wrist" to remove a reflector for cleaning. The ballast, now externally mounted, provides a power factor ranging from 92 to 99%.

Westinghouse Double-Reflector Continuous Strip Luminaires are available for use with four or six 40-watt (or four 100-watt) Mazda F Lamps. Any one of 117 Westinghouse Electric Supply Company Offices or Independent Westinghouse Lighting Distributors will give you full details regarding these luminaires and their installation. Or you can write Westinghouse Electric & Mfg. Company, Edgewater Park, Cleveland, Ohio.

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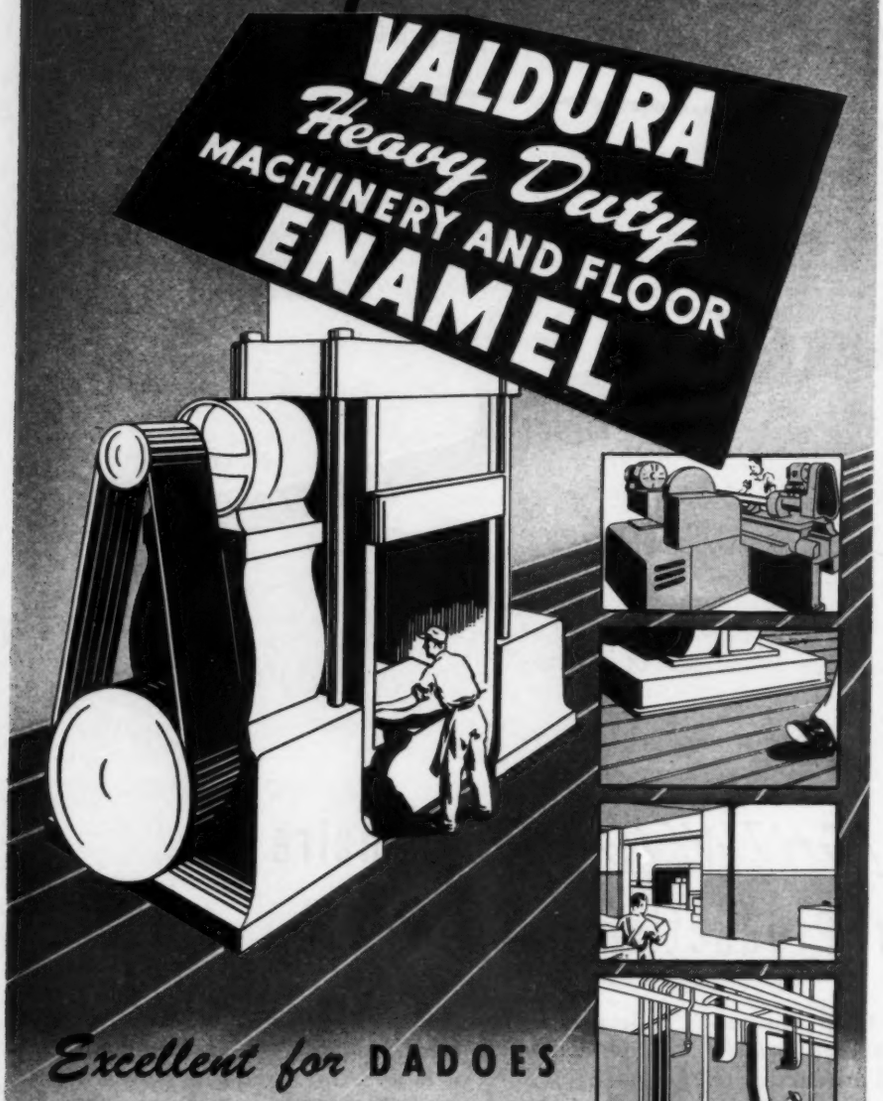
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

For Surfaces Subjected To Heavy Wear . . . Use



A super-tough enamel providing years of dependable protection.

Ideal for surfaces subjected to the scuffing grind of countless footsteps, exposure to fumes, grime, dirt, grease, temperature extremes and constant washing.

Extensively used on floors, machinery, dadoes and for pipe identification. Available in 14 colors as well as Black, White and Clear. Write Department C for information today.

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Using Color to Train Women

F. W. ROHDE, Chief Inspector, Plant No. 2, Jacobs Aircraft Engine Company, Pottstown, Pa.

WE HAVE BEEN USING a system of color teaching that has given us gratifying results in training women for work as inspectors. It was incorporated into our program as the result of our search for a more rapid and progressive method for teaching large numbers of unskilled workers a highly skilled trade.

This innovation was based upon the unanimous opinion of advertising people that the public is "eye-minded." Our mass of green labor is this eye-minded public, and our premise in making our adaptations was based on the fact that, if eye-mindedness could sell merchandise, it could also sell the information needed to do a job. Ordinary teaching methods cannot be depended upon to acquaint students with an idea, but to render that idea applicable to their working needs demands something more than a cut-and-dried system, particularly when those students are largely unaccustomed to study of any kind.

To achieve the greatest possible efficiency in our training methods, quite a number of factors had to be taken into consideration—lack of confidence, inability to learn, distaste for the mental effort of study, long hours of class work, mental fatigue, disinterestedness, and fear of failure. Any system of teaching that could eliminate a percentage of these elements was desirable, and color proved to be the answer to many of them. The fear of failure and lack of confidence in the ability to learn arise mostly from the student's inability to follow the written or spoken word to a clear conclusion.

Three-Phase Training

Our training period is divided into three phases: (1) Tools and gages, (2) blueprint reading, and (3) engine outlines. Tools and gages absorb about half of the training period, and the balance of the time covers the remaining subjects more than adequately. An initial training period of two weeks is necessary as the minimum period of time in which instructions can be properly absorbed.

The primary interest of the trainee inspectress, upon entering classwork preparatory to the actual assigned work, can be summed up in two questions: "What do I have to do?" and "How am I going to do it?" It is during the first days of training that these and similar questions are answered and the pace for serious industry is set.

In adapting color to our opening lectures, highly colored blackboard illustrations were made to handle lengthy written or oral explanations which a percentage of students found hard to follow. There is no doubt that mental fatigue and lack of concentration are due more to the unwillingness of the students to apply themselves to learning than to their inability to learn. The scholastic formula for teaching drugs the disinterested

This Emerson-Electric 300 Amp. Portable A. C. Arc Welder has a service record of 6000 production hours without maintenance expense. Photographed on the job.

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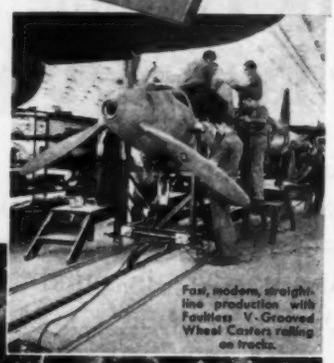
..TO PRODUCTION MEN WITH MAN-SHORTAGE PROBLEMS

SAVING seconds . . . minutes . . . man-hours rolling work past workers, is the fast, fluid way of *producing more* of anything at maximum efficiency. It's your practical solution to the man-shortage problem.

To do the job faster and better, Faultless Engineers have produced a series of Casters especially designed for high-speed production. Typical is the H 300-V Caster with grooved wheel that runs on or off grouted track—giving new speed and flexibility to plant production. This, and many other new Faultless products, will be found in Catalog No. 155 just off the press.

Faultless sales engineers are always available for consultation. Your request for a Caster survey will be promptly honored. Write for your copy of No. 155 Catalog.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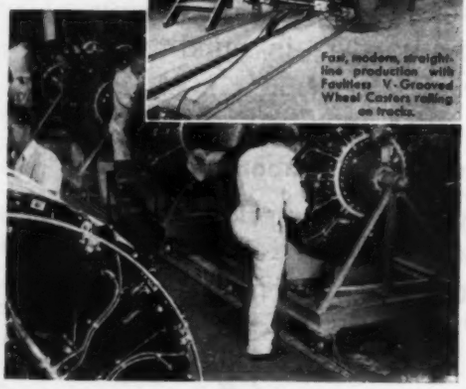

FAULTLESS CASTER CORPORATION
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FAULTLESS
INDUSTRIAL CASTERS

dent, and the only remedy with which we could meet this challenge was one that riveted their attention by eye-appeal. Color met this challenge with complete satisfaction. The array of brilliantly colored designs that took form on the blackboards were neither confusing nor monotonous. Like a colored moving picture, each new set of designs was eagerly anticipated and observed. The tendency toward class analysis stepped up perceptibly. Almost without a word being spoken in explanation, we found that a high percentage of the students could readily explain the purpose of the designs and that they enjoyed exercising their ingenuity in deciphering them. This stimulated their interest and improved their powers of observation and concentration.

Simple forms, such as splines, were drawn in cross section. The female part was colored in brilliant yellow, the male in bright blue. Then the two separate parts were drawn together as they assemble. It is readily discernible why a short, pertinent phrase or two is all that is necessary to make the purpose of the splines evident.

Note—Taking a Problem

But color alone would not have sufficed to impress a great number of facts indelibly upon the students' minds. However colorful the illustrations, written notes were a vital necessity for study outlines and a future reference compendium. There, too, we had a problem. Accurate transcription from blackboard notes could not be assured if they were written in the ordinary white chalk in the usual manner. The tendency to omit important phrases and even whole sentences was a hazard we could not afford to ignore. In the beginning, these notes were quite lengthy and employed the use of much unfamiliar shop phraseology and detail applying to small items of vital importance that were imperative information if the job were to be done well.

It would have been possible to put these notes into printed form, but the conclusion that this would have served our needs for both speed and accuracy is faulty. The effort that each student makes in taking notes, transcribing them, and redrawing each design, serves a sound purpose within itself that printed lesson sheets would eliminate.

Color Outline

Our problem, therefore, was to formulate a method of written presentation that avoided these undesirable qualities. To do this, we revised our phrasing, constructed an outline form of explanation, and borrowed from color again to lay stress upon the important details and words of warning. The results were more than we hoped for from many points of view. Key points of similarity in gages were more easily identified when identical color was used to draw the attention to that likeness.

The *no-go* threaded plug and ring are illustrative. Both of these gages check the pitch diameter *only*. The reverse was stressed with color to explain the *go* plug and ring; each checks a different diameter and that difference was accentu-

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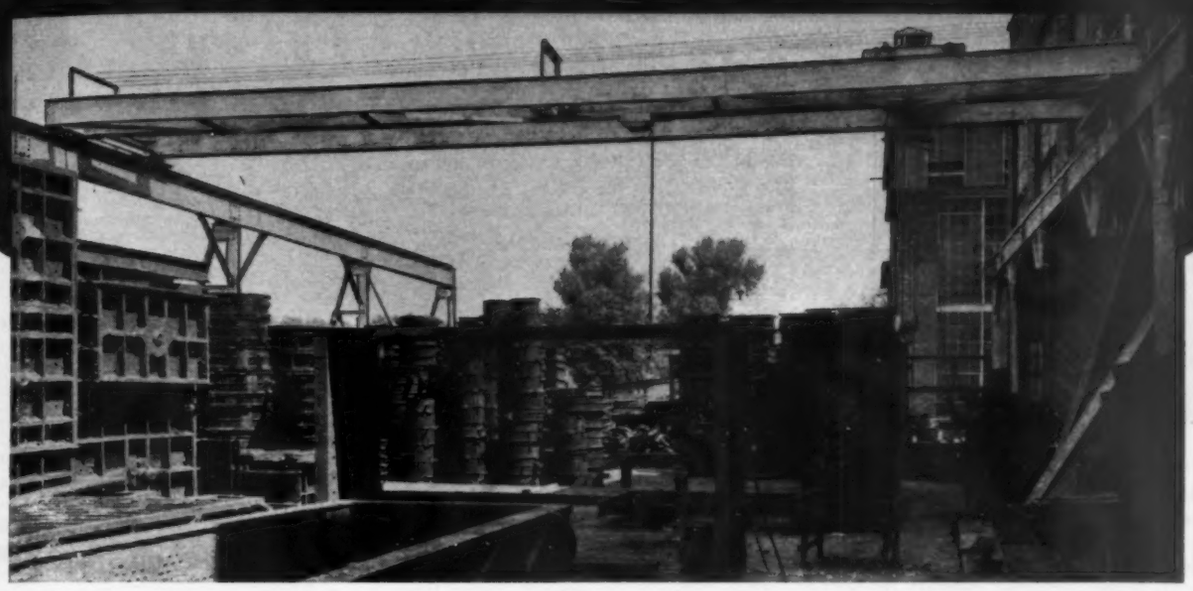
will help you meet *Postwar* Competition!



In converting for war, many plants—particularly those of small or medium size—were compelled to sacrifice production economies in the interest of frantic speed. That is always the case in war.

But when these plants convert back to peace and face terrific competition in postwar production they will have to cut manufacturing costs and still maintain a volume output. R & M Cranes can help them.

Regardless of your industry, R & M Cranes can effect definite important savings by making possible the faster, more efficient handling of loads in your plant or yard. They can eliminate all re-handling in lifting, moving and placing, prevent bottlenecks at many points and slash labor costs to the minimum.

Now, while you are carefully planning your setup for postwar manufacture, is the time to have an R & M Hoist & Crane expert make a survey of your needs. No obligation is incurred and it may mean much to you. Depending on the size of the cranes you need, we can make delivery in 3 to 6 months. And whichever model you choose—from ½ ton to 25 tons in capacity—you have absolute assurance of traditional R & M performance, dependability and economy.

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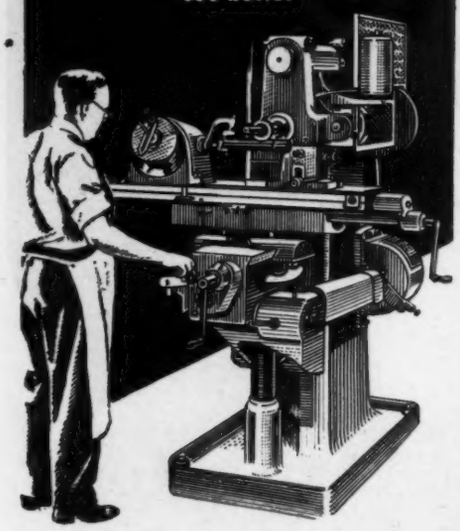
LIGHT FROM FLOORS

helps war workers see better



TO INCREASE the effectiveness of the lighting facilities, plants built for Boeing, Consolidated, Douglas and North American have light-colored concrete floors made with *white* portland cement instead of with *gray* portland cement or other darker materials.

Tests in Consolidated's plant at Fort Worth show that the white-cement floor compared with a gray-cement floor in the same plant reflects 61% more light to underside of wings and provides 20% more light on vertical faces of work.

Because it salvages waste light, a light-reflecting concrete floor made with Atlas White cement—

- ***decreases shadows and dark areas;***
- ***makes seeing easier and quicker;***
- ***reduces eyestrain, headaches and absenteeism;***
- ***reduces accidents, errors, spoilage and shutdowns;***
- ***increases quantity and quality of production.***

Maintenance is simple—frequent sweeping, occasional damp mopping, periodic scrubbing.

Write for new book, "Light From Floors." It gives detailed information on the value, installation and maintenance of light-reflecting concrete floors made with Atlas White portland cement. Universal Atlas Cement Company (United States Steel Corporation Subsidiary), Chrysler Building, New York City.

F-F-22

ATLAS
WHITE CEMENT
For Light-Reflecting Floors

diameter and that difference was accentuated by a radical change in the color used in writing the explanatory phrases. Written side by side, the color alternation threw this difference into the glaring relief which eliminated later confusion of terms and pertinent facts.

Dial Reading

Previously we had experienced some difficulty in teaching dial reading. This was entirely cleared up by matching the dial illustrations to the text with color. The appearance of a blackboard containing three dials and their reading instructions is both interesting and colorful. It is a frank appeal which few students ignore. This serves three purposes. It forces them to use their own heads to think out the solutions, prevents the indifference and boredom resulting from mental inactivity —and it teaches dial readings comprehensively.

Plain go and *no-go* gages are among the first that we teach. With our previous success in color still in mind, we made an interesting use of two common colors—red and green. The colors in themselves made explanation almost unnecessary; green for go and red for *no-go* were only too obvious.

Threads and thread gages gave us the most trouble. This was caused by a number of things—thread terminology, the similarity of plain gages in usage and principle, and the problem of differentiating clearly between the work and the gage.

With the limited amount of time at our disposal for the teaching, we could not allow threads to absorb more than a given number of hours. Once again, color solved our problem to an appreciable degree. In our diagrams we kept all the thread gages in one solid color and the work, whether external or internal, in another solid color. Step by step we related color to the terms and phases of the work until we had cut hours from our teaching time and impressed upon the minds of the students an array of clearly defined facts.

Practice has justified the adoption of this procedure in teaching the use of tools, gages, dials, micrometers, threads, and all the subjects we must cover in our first five to six training days. Proof of the efficiency of this method is shown by the results we witness after the students are placed in active service, and by the marks they get on their final examinations.

"Blueprint Reading"

The students entering our classes know what a blueprint is, but most of them have never seen one. To maintain our schedule it is necessary that we train our classes so that they can read nearly any part print in 2 to 2½ days. This order was almost as large as it sounded until we applied our acquired knowledge of "eye appeal" to its accomplishment. It will be understood that when we use the term "blueprint reading," we do not use it in the technically accepted sense of the word, but only to the extent that it is needed in inspection work. Regardless of this fact, it is no small job to train a complete

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- Centrifugal type (no magnets) with uniform scale over entire dial
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Our engineering staff will convert any model to meet your special requirements. Write for catalog.

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1 RUGGED PLASTIC BODY AND HANDLE

2 MOTOR OF FINEST ALLOY STEELS

3 FULL BALL BEARING CONSTRUCTION

4 1 LB. 12 OZ. WEIGHT

5 6¼" OVERALL LENGTH

6 2500 RPM

7 1/8", 3/16", ¼" OR 5/16" JACOBS CHUCK

THE NEW ARO PNEUMATIC DRILL WITH *Plastic* CASE

Again ARO Engineering Leadership scores an important "first"—bringing you this new Model 101 ARO Pneumatic Drill with *all-plastic housing and handle!* It's today's lightest-weight portable pneumatic drill—yet it packs power-to-spare and durability for toughest small tool production jobs. Its lightness makes it ideal for women workers. Trigger touch controls speed.

Proved in exhaustive tests in our laboratories and in numerous production lines... this new ARO Pneumatic Drill meets industry's need for *greater speed* and *less fatigue* in round-the-clock production. Investigate ARO!

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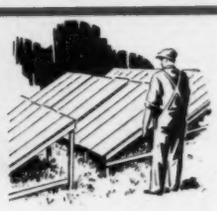

IT HAS *Greater* RUST-RESISTANCE

Lead does not corrode or weather away through galvanic action when in contact with steel. Properly applied, a lead coating for steel sheets affords longer-lived protection against rusting or corrosion of the base metal.

IT *Takes* PAINT

The new lead-alloy coating gives an ideal painting surface. LEAD-SEALED sheets TAKE and HOLD paint and synthetic enamels without preparatory treatment. This saves both time and cost in manufacturing operations.

IT SOLDERS *Easily*

Continental LEAD-SEALED solders fast and easily, without the use of flux or acid. Less solder is required. Both simpler and easier than soldering zinc-coated sheets, there is a worthwhile saving in time and effort.

IT'S *More* WORKABLE

Softer, more ductile, LEAD-SEALED sheets possess a high degree of workability. The coating serves as an effective lubricant for dies. It withstands severe forming operations without flaking or peeling.

Already new LEAD-SEALED has demonstrated superior properties for such uses as: fire doors, heating and ventilating equipment, chemical containers, gasoline cans, tanks and a score of other products. In many industries, Continental LEAD-SEALED has replaced more critical materials and actually cut costs. LEAD-SEALED offers advantages for many kinds of products. It cannot and is not intended to replace galvanized or long terne sheets for all purposes. Perhaps this new sheet is your answer to a better product. Write, explain your problems, ask for a sample.

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SUPERIOR

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novice to be able to identify and locate dimensions and follow blueprint notations on, say, a cylinder head print in the time allowed. However, it has been done and to a large degree the use of color has been responsible for the degree of success we have achieved. Our elementary blueprint course follows well-prescribed lines throughout with the exception of print analysis. Print analysis is handled almost entirely visually. In other words, the blueprint is drawn on the blackboard at the student's instruction.

First, the left-hand view is decided upon, analyzed for reason, then drawn in a solid light-colored chalk. Object lines are then drawn in—external lines in red; internal lines in blue; hidden lines in green; angles, chamfers, radii, undercuts, etc., all carrying individual colors. In the sweep-up view these colors are related to the first view and to the part, with the result that within a surprisingly short time we are able to hand out a print and have the student pick out the part from a table littered with hundreds of parts. Needless to say, the dimension and projection lines are also carried out in color conformation. Today we have quite a gallery of blueprints drawn by these two-day students and we are justifiably proud of them.

Engine Outline

Where it has been expedient for us to give an outline course on the engine, we have found it more advisable to rely upon eye memory than upon the technical aspects of the engine parts. To this end color serves us admirably because color combinations can be used to identify many parts. For example, all gears turning counterclockwise may be easily recognized in distinction to those turning clockwise. Parts that ride on other parts are quite clearly discernible.

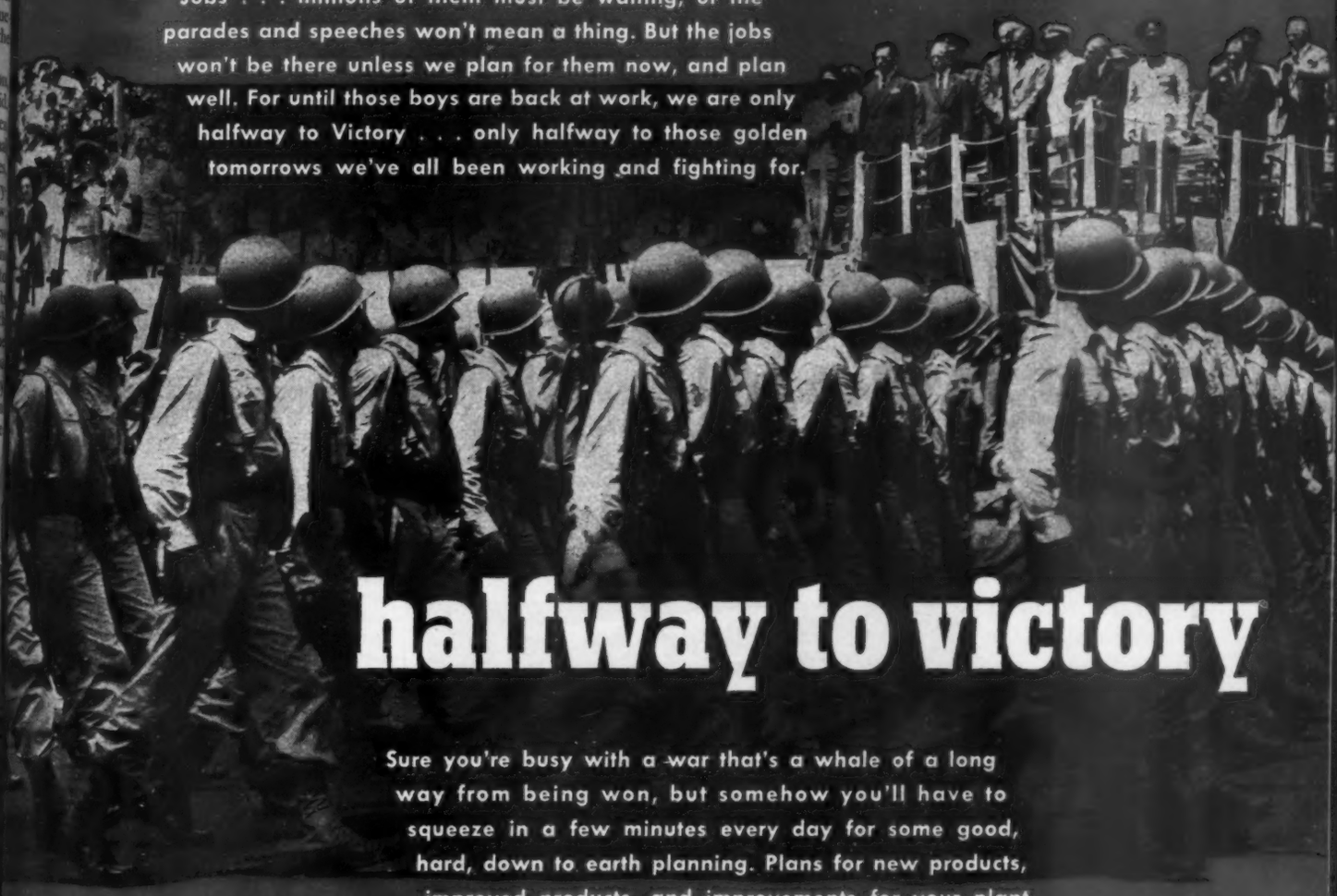
The method used has been to assemble the different parts in one section and then draw the assembly on the board, each part in a different color. We employ a number of color charts showing special assemblies, and they are so clear that the veriest novice can make the assembly with no oral instruction at all. This has worked excellently with the cylinder head by using black for the head and barrel, and various other colors for the valves, valve guides, seats, etc.

Our objective in giving the engine outline at all has been based on a number of interesting observations. An average class does almost brilliantly with this subject, regardless of how poorly they may have done in the foregoing work. We capitalize on this fact to teach the absolute necessity for inspection to adhere rigidly to specifications. It materially improves the attitude of the workers towards the work when they feel that they know how important a part is and why. It may seem childish to us, but it is true that even the ability to locate a part on the general blueprint and know what section of the engine it is in adds to their pride in their work. This is particularly true of the women, and the reason for this attitude is quite natural. For them, it is conquering work which they consider to be entirely masculine in scope.

Someday there will be Victory parades . . . lots of confetti and flowery speeches, but right around the corner from the speaker's platform there must be plenty of HELP WANTED signs.

Jobs . . . millions of them must be waiting, or the parades and speeches won't mean a thing. But the jobs won't be there unless we plan for them now, and plan well. For until those boys are back at work, we are only halfway to Victory . . . only halfway to those golden tomorrows we've all been working and fighting for.

buy more war bonds



halfway to victory

Sure you're busy with a war that's a whale of a long way from being won, but somehow you'll have to squeeze in a few minutes every day for some good, hard, down to earth planning. Plans for new products, improved products, and improvements for your plant.

And when you plan your motor drives, we would like to sit in with you, because we can really help.

Take this machine on the left for instance. It's powered by a Master unit, which is an integrally built motor, a mechanical variable speed drive, a gear reduction unit, and is supplied with a flange mounting so the whole unit fits neatly into the machine.

It can be supplied for single phase, polyphase, or direct current operation . . . in open, fan cooled, or explosion proof construction, with or without the gear unit, with or without the variable speed drive . . . with an integrally mounted electric brake, if required . . . and its construction can be modified mechanically so that its method of mounting is practically unlimited.

Such wide flexibility can aid you materially in adding to the economy, safety, compactness and appearance of your motor driven products or plant equipment.

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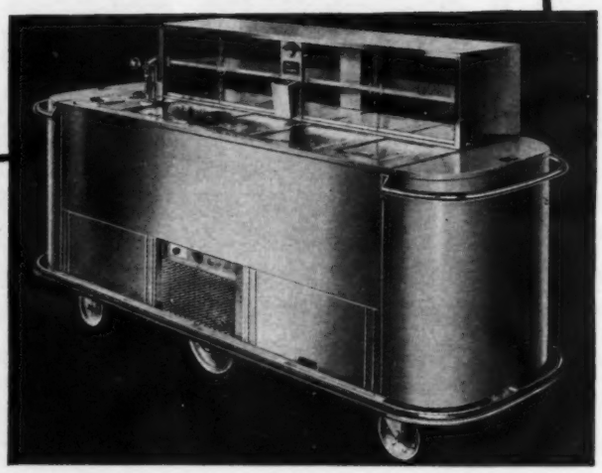

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● Bringing the food to the worker is only part of the picture. Ideal Rolling Cafeterias do far more.

You get 5° minus and 180° plus in the same mobile, complete, beautiful Ideal unit. Food can be stored indefinitely—or served hot or cold immediately as the need requires.

Ideal Rolling Cafeterias in your plant will help workers do more, make food go further. The money saving isn't so important but the food and time saved are priceless today. Floor space, too.

Many standard models, designed to meet war production requirements, are doing a job in hundreds of leading plants today. Write for complete data.

THE SWARTZBAUGH MFG. CO.

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BOOKS

MANAGEMENT OF MANPOWER

Asa S. Knowles, dean, School of Business Administration, Rhode Island State College, and Robert D. Thomson, associate professor of industrial management, Northeastern University. The MacMillan Co., 60 Fifth Ave., New York. 248 pages. Photographs, drawings, forms, charts, index. $2.25.

Among the outstanding problems facing industrial managers today is the effective use of manpower. This book is part of a larger volume on "Industrial Management," and is reproduced for those whose job it is to give their primary attention to manpower, and who need specific information. Chapters include "Organization and Morale," "Safety and Health," "Selection and Training," "Motion Study and the Worker," "Time Study," "Job Evaluation," "Merit Rating," "Employee Compensation." Questions and problems at the back of the book enable the reader to be sure he has mastered the text.

SHOP MATHEMATICS

Arthur B. Dick, B.S., M.A., Coordinator, Vocational War Production Training for Baltimore County, Md. The Ronald Press Co., 16 E. 26th St., New York. 230 pages Drawings, index. $2.40.

Planned for shop mathematics courses and vocational subjects of high school equivalence. Material is selected as basic and fundamental units for students pursuing vocational curriculums. Book is organized into teaching units and assignments, arranged in a definite sequential order. General divisions are: Arithmetical Fundamentals, Algebraic Equations, Geometrical Constructions, Geometrical Computations, Mechanical Applications, Practical Trigonometry.

THE PSYCHOLOGY OF EFFICIENCY

Arthur Gilbert Bills, professor of psychology, University of Cincinnati. Harper & Bros., 49 East 33rd St., New York. 361 pages. Charts, supplementary reading lists, test items for review, subject and author indexes. $2.75.

Designed to tell the normal, well-adjusted individual, geared to a daily program of work, how to get the most efficient service from his own mental mechanism. Book discusses mental work as a psycho-physiological process, and shows its subjective aspects. A book for the individual reader or as a textbook for courses in personnel psychology. Test questions arranged by chapters are designed to give the reader an opportunity to check his grasp of points covered in the text.

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BOOKLETS

THE GRAY PLAN. Preliminary statement of the Gray plan for post-war reemployment. Carl Gray, president, Grenby Mfg. Co., Plainville, Conn. 39 pages. Two-page chart. No charge.

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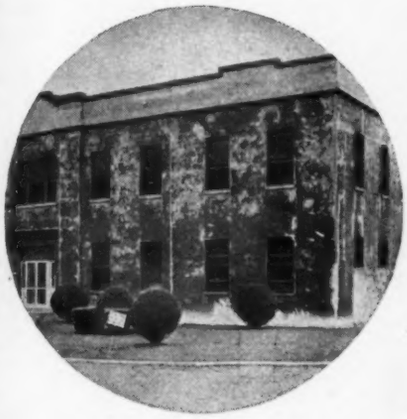

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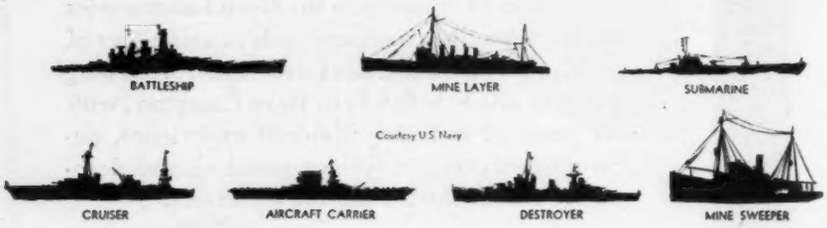

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THE KITCHEN IN WAR PRODUCTION. Helen Hill. Wartime food hints. Public Affairs Pamphlet No. 82. Public Affairs Committee, Inc., 30 Rockefeller Plaza, New York. 30 pages. Charts. 10c.

RADIO DATA BOOK. Edited by Lt. Nelson M. Cooke, U. S. Navy. Allied Radio Corp., 833 W. Jackson Blvd., Chicago. 48 pages. Diagrams. 25c.

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REBUILDING EUROPE—AFTER VICTORY. Hiram Motherwell. Public Affairs Pamphlet No. 81. Public Affairs Committee, Inc., 30 Rockefeller Plaza, New York. Drawings. 10c.

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WAR STRATEGY AND POST-WAR PROBLEMS. Three lectures—War Strategy and War Politics, J. E. Wallace Sterling; Labor and the Post-War World, Arthur H. Young; The Beveridge Plan: A Symbol, Edwin F. Gay. California Institute of Technology, Pasadena, Calif. 59 pages. No charge.

IDEAS THAT WORK TO WIN. Guide to management for establishing and conducting incentive measures. Industrial Incentive Division, Navy Department, 2118 Massachusetts Ave., N.W., Washington, D. C. 21 pages. Drawings. No charge.

ACCIDENTS FACTS, 1943 EDITION. Prepared by Statistical Bureau of National Safety Council. National Safety Council, Inc., 20 N. Wacker Drive, Chicago. 96 pages. Tables, graphs, charts, drawings. One to 10 copies, 50c. each; 11 to 100, 35c. each; 101 to 1000, 25c. each; over 1000, 20c. each.

MAXIMUM UTILIZATION OF EMPLOYED MANPOWER. A check list of company practice. Also included a check list for plant management. Industrial Relations Section, Department of Economics and Social Institutions, Princeton University, Princeton, N. J. 46 pages. $1.

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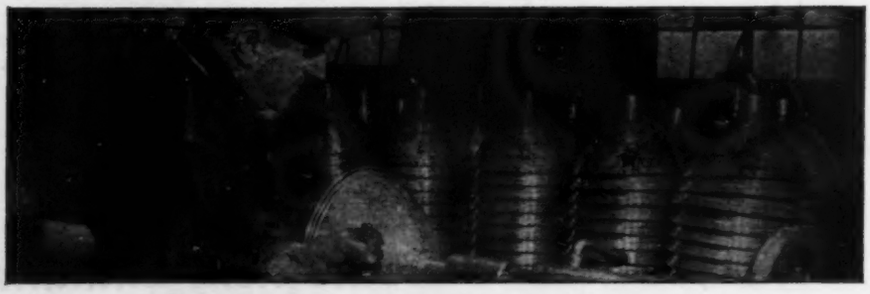

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ON THE CALENDAR

SEPTEMBER

2–4, American Institute of Electrical Engineers, National Technical Meeting, Salt Lake City. H. H. Henline, Secretary, 33 West 39th St., New York.

6–10, American Chemical Society, Semiannual Meeting, Minneapolis. Alden H. Emery, Assistant Manager, 155 Sixteenth St. N. W., Washington, D. C.

23, Association of Consulting Management Engineers, Inc., Meeting, University Club, New York. Nathaniel W. Barnes, Executive Secretary, 347 Madison Ave., New York.

28–30, Association of Iron & Steel Engineers, Annual Convention, Hotel William Penn, Pittsburgh. Brent Wiley, Managing Director, Empire Building, Pittsburgh.

OCTOBER

5–7, National Safety Council, 32nd National Safety Congress and Exposition, Sherman Hotel, Chicago. Ned H. Dearborn, Executive Vice-President, National Safety Council, Inc., 20 N. Wacker Drive, Chicago.

18–21, American Welding Society, Annual Meeting, Hotel Morrison, Chicago. M. M. Kelly, Secretary, 33 W. 39th St., New York.

18–22, American Society for Metals, National Metal Congress and Exposition, Palmer House, Chicago. W. H. Eisenman, Secretary, 7301 Euclid Ave., Cleveland.

19–21, American Institute of Accountants, 56th Annual Meeting, Waldorf-Astoria Hotel, New York. John L. Carey, Secretary, 13 E. 41st St., New York.

25–29, National Electrical Manufacturers Association, Annual Meeting, Waldorf-Astoria Hotel, New York. R. J. Blair, Convention Manager, 155 E. 44th St., New York.

28–29, American Institute of Mining Engineers & American Society of Mechanical Engineers, Joint Fuels Conference, William Penn Hotel, Pittsburgh. Harry Maloney, Assistant Treasurer, 29 W. 39th St., New York.

NOVEMBER

10–11, Industrial Hygiene Foundation of America, Inc., Eighth Annual Meeting, Mellon Institute, Pittsburgh. John F. McMahon, Managing Director, 4400 Fifth Ave., Pittsburgh.

30, Association of Consulting Management Engineers, Inc., Annual Meeting, University Club, New York. Nathaniel W. Barnes, Executive Secretary, 347 Madison Ave., New York.

INDUSTRIAL HYGIENE COURSE

October 19–21, Continued Education Course in industrial hygiene for plant safety personnel. H. E. Miller, Chairman, Planning Committee for In-Service Training Course for Plant Safety Personnel, University of Michigan, School of Public Health, Ann Arbor, Mich.